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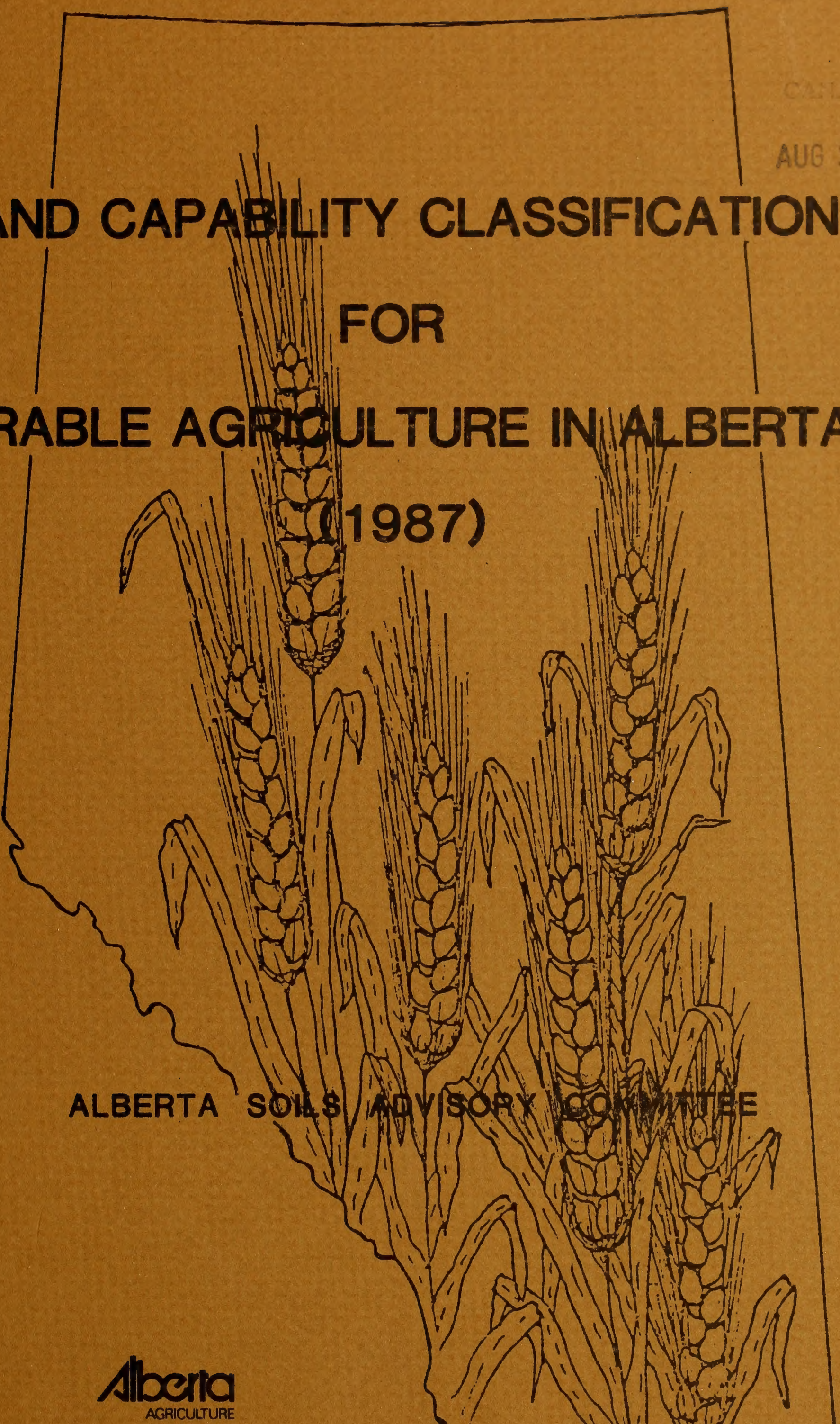
LAND CAPABILITY CLASSIFICATION FOR ARABLE AGRICULTURE IN ALBERTA (1987)



ALBERTA SOILS ADVISORY COMMITTEE

Alberta
AGRICULTURE

Land Capability Classification
for
Arable Agriculture in Alberta
(1987)

Technical report prepared by
Agricultural Rating System Working Group
of the Soil Inventory Subcommittee
of the Alberta Soils Advisory Committee
and
Agrometeorology Working Group
of the Alberta Agrometeorology Advisory Committee

Edited by W.W. Pettapiece

Alberta Soils Advisory Committee
1987

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Copies may be obtained from:

Secretary, Alberta Soils Advisory Committee
c/o Soils Branch, Alberta Agriculture
7000 - 113 Street
Edmonton, Alberta
T6H 5T6

Agriculture Rating System Working Group

A. Fenton	Alberta Municipal Affairs
C. McGregor	Alberta Forestry, Lands & Wildlife
L. Marciak	Alberta Agriculture
W. Pettapiece	Agriculture Canada (Chairperson)
R. Shorten	Alberta Forestry, Lands, & Wildlife
A. Twardy	Pedology Consultants

Agrometeorology Working Group

S. Dupuis	Alberta Forestry, Lands & Wildlife
R. Heywood	Alberta Agriculture
W. Hume	Environment Canada (AES)
D. Lewis	Alberta Agriculture (Chairperson)
P. Mills	Agriculture Canada

Preface

This report outlines a system for the classification of land capability for arable agriculture in Alberta. The system was developed in response to two interdepartmental concerns:

1. Various government departments were using different systems for rating agricultural lands, and
2. There was a need for a more specific detailed system to address large scale concerns.

The system described herein is intended to replace all previous systems in order to provide a single, consistent assessment of agricultural capability in the province. The system is based on land and environmental factors as they affect arable agriculture. It is restricted to dryland (rainfed, not irrigated) agriculture and based on the common crops and management systems of the day. Economics are explicitly excluded apart from minor management considerations implicit in some of the applications. It must be stressed therefore that these ratings do not in themselves indicate "most profitable" or "best" use and that they should not entirely substitute for a planning function which should include economic and social considerations. The ratings do, however, provide one of the essential ingredients in any land use decision involving agriculture.

The system was developed by an interdepartmental working group under the auspices of the Alberta Soils Advisory Committee. The committee included representatives from Alberta Agriculture, Alberta Forestry, Lands, and Wildlife, Alberta Municipal Affairs, Agriculture Canada and the private sector. It reviewed the existing systems, two based on a Storie Index and the Canada Land Inventory, Soil Capability for Agriculture and documented general criticisms and needs. The group concluded that:

a) Land use planning was the main underlying concern,
b) A "capability" rather than a "productivity" system was preferred,
c) The concepts of the Canada Land Inventory classes should form the base,
d) Individual factors should be documented and indexed, and
e) Three main components - climate, soils and landscape should be recognized.

The Alberta Agrometeorology Advisory Committee was approached with the request to develop appropriate climatic parameters for agricultural rating. Again an interdepartmental working group was established.

A preliminary draft of the system was developed by May, 1985. It was reviewed, tested and amended. A "working document" was published in June 1986 and was field tested during the summer and fall of 1986. Comments and concerns were solicited, reviewed and the working document amended as required.

All users are encouraged to comment on any portion of the technical or descriptive aspects of this publication. Please refer to the "tear out" sheet at the back of the report. Comments should be forwarded to:

Secretary, Alberta Soils Advisory Committee
c/o Soils Branch
Alberta Agriculture
7000 - 113 Street
EDMONTON, Alberta
T6H 5T6

W.W. Pettapiece, Chairperson
Agricultural Rating System Working Group
May, 1987

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Much of the material in this manual comes from other sources but the working group accepts responsibility for any misrepresentation caused by editing and reorganization of material.

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Chapter I Introduction

Land inventories have always been conducted with the objective of making interpretations for some purpose or use. A principal interpretation in the prairie region has been for agricultural uses. Initially, with only a few people involved, one system for rating agricultural lands was developed. However, over the years additions were made, new agencies incorporated modifications for specific purposes and even new systems were introduced. Concern had been expressed at the Alberta Soils Advisory Committee meetings for several years that the use of several different systems in the province was leading to unnecessary confusion and conflict.

In November 1981 the Soil Inventory Subcommittee presented the following resolution to the Alberta Soils Advisory Committee:

Whereas:

1. There are a variety of ways to rate soils and land for agricultural purposes,
2. Each government agency uses a different approach, and
3. It is confusing and time consuming for planners and developers, both in and out of government, to prepare competent plans and reports.

Therefore be it resolved that:

An interagency working group be established to document and correlate the present approaches. A view to standardization should be considered.

Phase I. In February 1982 the problem was referred back to the subcommittee who established an Agricultural Rating Systems Working Group. This was an interdepartmental group with members from Alberta Agriculture (Land Use Branch), Alberta Energy and Natural Resources (Resource Evaluation and Planning, and Public Lands Division), Alberta Municipal Affairs (Assessment Services), Agriculture Canada (Soil Survey) and the private sector.

The terms of reference were limited to arable agriculture with the following specific objectives:

1. To document the commonly used systems,
2. To compare the systems and provide correlations,
3. To identify weaknesses and problem areas,and
4. To make recommendations.

The commonly used systems were the Farmland Assessment Schedule of Municipal Affairs (Department of Municipal Affairs 1979), the Public Lands System (Storie 1933) and the CLI - Soil Capability for Agriculture (Brocke 1977, Canada Land Inventory 1965). A report was prepared for the Soil Inventory Subcommittee by February 1983. It was published in late 1983 (Alberta Soils Advisory Committee 1983). The report concluded that in spite of the differences, many of the factors such as texture, surface features and subsoil features are treated in comparable, often identical, manners. And, the final ratings by all systems were usually quite close even though they might be reached by different routes. It went on to say that "it would appear feasible with some adjustments, to develop a single basic system."

The conclusions were made known to the departments concerned via the Alberta Soils Advisory Committee. The Soil Inventory Subcommittee was then requested to proceed with the development of a single rating system for Alberta.

Phase II. In June, 1984 the working group was reconvened to consider the task. All members agreed to continue on the second phase and after a good deal of discussion, agreement was reached on the following guidelines:

a) It should be a capability system to support planning needs,
b) It should be specific enough to allow various workers to reach similar conclusions,
c) The report should include a "how to use" section, and
d) A document should be ready for trial by May, 1985.

Further discussion of the system suggested that it recognize three major components, each to be rated separately:

1. Climate (moisture, energy),
2. Soils (surface, subsurface), and
3. Landscape

In October, 1984 the working group approached the Alberta Agrometeorological Advisory Committee with a request to develop appropriate climatic parameters for agricultural rating. They agreed and a second interdepartmental working group was established for that purpose.

The first approximation of the system was available in May, 1985. It was tested by several groups during the summer. In October the working groups met jointly to consider the results of the testing, to identify areas requiring further input and to integrate the climate section. Reviews and modifications were continued during the winter culminating in a "working document" which was published in May, 1986. Four hundred copies were distributed covering all agencies involved in rating land in Alberta. In addition , copies were sent to soil survey organizations across the country and to other interested parties.

About 1000 sites were rated in a general testing program. Some of the ratings were conducted as part of routine soils interpretations while others were in more controlled settings. Based on this experience changes were made in the organization of the Landscape section, in the Organic soils rating and in the treatment of soil texture.

The climate rating was more difficult to check than the soils and landscape sections. However a test was devised based on the assumption that crop choice would reflect climatic restraints. Categories were established based on considered opinion and were mapped using 1981 Census data. A panel of knowledgeable agronomists was assembled to assess the results. Comments from this exercise resulted in a reduction of the daylength factor and minor changes to the rating schedules.

ChapterII System Development

A. Approaches and Assumptions

The guidelines suggested the use of a capability approach to the rating of land for arable dryland agriculture. Following are some definitions which are relevant to the rating system:

1. Capability - focuses on the nature and degree of limitations imposed by the physical characteristics of a land unit for a certain use (Smit et al 1983).
2. Arable - tillable; agricultural production based on cultivation practices; land that is cultivated or capable of being cultivated. Arable is used in contrast to agriculture based on grazing (non-cultivated) systems.
3. Dryland (rainfed) - an agricultural system based on natural precipitation - in contrast to irrigated systems.

As a starting point, the basic concepts of the Canada Land Inventory: Soil Capability for Agriculture (Canada Land Inventory 1965) were adopted. This is a seven class system with class 1 having the highest capability (least limitations) and class 7 having the lowest capability (greatest limitations). Also accepted were the general assumptions of the CLI which were:

a) It is an interpretive system based on limitations for agriculture and general productive capacity for common field crops. In the Alberta situation this includes the small grains (wheat, barley and oats) and oilseeds (represented mainly by canola). Present land use is not considered diagnostic.

b) Good soil management practices that are feasible and practical under a largely mechanized system of agriculture are assumed.

c) Lands in each class are similar with respect to degree, but not necessarily to kind, of limitations for arable agriculture. Therefore, lands in any one class may require different management or treatment.

d) Lands are classified according to their continuing limitation assuming feasible improvements will be made. Examples are minor drainage, conservation measures and stone removal or other improvements within the means of individual producers.

e) The capability classification could change with major changes in such features as land use, drainage schemes or climate.

f) Off-farm economics such as, distance to market, size of farm, kind of roads or grain market prices are not considered.

g) Capability grouping could change as more information becomes available on soil response or crop requirements.

However, the guidelines also suggested that a specific, quantitative methodology was required to reduce subjectivity. An indexing approach, such as used in the Storie system, has some advantages so the following class/index framework was established.

Table II-1. Relationship of capability class to index point

Capability class	Index points	Limitation
1	80-100	none to slight
2	60-79	slight
3	45-59	moderate
4	30-44	severe(marginal)
5	20-29	very severe
6	10-19	extremely severe
7	0-9	not useful

The next consideration was the accommodation of the three major components climate, soils and landscape. It was agreed that each could by themselves be limiting to agriculture. Therefore each should be considered separately and each should be assessed over the total scale, that is, each assessed a value between 0 and 100. The final rating would be based on the most limiting of the three, not on the accumulated total.

While the final class placement is based on the most limiting component, the system also allows for the identification of specific factors and the relative contribution of each. This is important for the planning process or for land evaluation because some limitations might be corrected or managed while others might not. That becomes part of the considerations. For example, if there were three areas of class 4; one with climate limiting, one with soils and one with landscape, they could and should be considered separately. Climate generally has to be accepted as it exists but soils might be readily improved and landscape might be a management concern. The identification and rating of each limitation was therefore accepted as the preferred approach and any limitation resulting in a one class or greater reduction would be shown in the rating symbol.

The assessment of degree of limitation (how many points to deduct in a given situation or the development of rating scales) became a separate process for each parameter. It was carried out within the context and meaning of the rating system - Class 1 is none to slight limitation, Class 4 is marginal, etc. Critical points or characteristics were identified and the scale constructed. The process was interactive and based on our knowledge and understanding of how the various parameters affect the identified use. For example, critical points for assessment of pH were as follows:

pH	Rating	Class	Point deduction
3.0	no value for arable agriculture	7	100
4.5	slight to moderate limitation	2	30
6.5-7.5	no limitation for arable agriculture	1	0

It was also recognized that some factors were less important than others. The ratings were adjusted to reflect this concern in two ways:

a) The whole range of 0 to 100 was not used for some parameters. Organic matter content with a maximum 15 point deduction is an example.
b) Some factors were considered to be modifiers to a base rating and were treated as percentage rather than absolute deductions. The drainage factor is an example of this approach. This also recognizes that the class limits are not all equal, becoming narrower at the lower ratings.

B. System Description

The new system retains a close similarity to the older CLI - soil capability for agriculture system (Canada Land Inventory 1965) but attempts to be more quantitative. In both systems land is grouped into seven classes according to their potentialities and limitations for agricultural use. The definition of the classes are essentially the same as previously defined (op cit) except that a range of index points is now assigned to each class. The first three classes are capable of sustained production of common cultivated crops, while the fourth class is considered marginal.

The classes, the broadest category in the system, are an assessment of the degree of intensity of limitation. For example, Class 3 land has limitations which are more severe than Class 2 land. The second category, the subclass, describes the kind of limitation responsible for the class designation. Thus, when used together, the class and subclass provide information about the degree and kind of limitation. This information is useful for land use planning and for determining conservation and management requirements.

1. Land capability classes

Class 1 - These lands have no significant limitations for crop production (80-100 index points).

Class 2 - These lands have slight limitations that restrict the range of crops or require modified management practices (60-79 index points).

Class 3 - These lands have moderate limitations that restrict the range of crops or require special management practices (45-59 index points).

Class 4 - These lands have severe limitations that restrict the range of crops that can be grown or require special management practices or both (30-44 index points).

Class 5 - These lands have very severe limitations for sustained arable agriculture. Annual cultivation using common cropping practices is not recommended (20-29 index points).

Class 6 - These lands have such severe limitations for arable agriculture that cropping is not feasible even on an occasional basis (10-19 index points).

Class 7 - These lands have no capability for arable agriculture (0-9 index points).

It must be emphasized that lands within a capability class are similar only with respect to the degree of intensity of limitation and not the kind of limitation. Each class includes many different kinds of soil and land characteristics and many of the soil and land characteristics within any one class may require different management practices.

Note too that no assessment is made with regard to pasture or grazing. Classes 5 and 6 while not recommended for cultivated crops could have potential for grazing.

2. Land capability subclasses

The subclass is a grouping of soils and lands with the same kind of limitation. Twenty one different kinds of limitations are recognized as a result of adverse climate, soil or landscape characteristics. The subclasses are as follows:

Climate (C)
- moisture limiting factor (A)
- temperature limiting factor (H)

Soils (S)
- texture in mineral soils (M)
- structure and consistence in mineral soils (D)
- organic matter content (F)
- depth of Ah or Ap in mineral soils (E)
- acidity/alkalinity (V)
- salinity (N)
- sodicity/saturation percentage (Y)
- calcareousness (K)
- peaty surface (O)
- depth to nonconforming layer (R) (D) (M)
- drainage (W)

Organic soils (O)
- organic soil temperature (Z)
- degree of decomposition (B)
- wood content (I)
- nutrient status (G)
- salinity (N)
- depth of deposit (X)
- subsurface acidity (V)
- drainage (W)

Landscape (L)
- slope (T)
- surface stoniness (P)
- pattern (J)

C. Information Requirements

In order to use the rating system data are required for each of the identified factors within the climate, soils and landscape components. Some can be estimated from maps and reports, other data are best collected by site inspection. The level and purpose of the capability rating also has a bearing on the detail required, with regional assessments generally satisfied by estimates from published data but assessment of individual land parcels requiring detailed site investigations. Individual parameters also differ in their data requirements.

1. Climate data requirements

The climate parameters are based on long term records, 1951-80 normals wherever possible. The data are therefore best obtained by estimating values from the attached maps. If documented local knowledge is available, the assessor has the option of adjusting the parameters. This is particularly applicable to the modifying or "fine tuning" of local factors. Such adjustments should always be made with specific reference to the suggested values.

If one wished to make a very detailed local analysis of the climatic parameters and had access to site specific data it would be appropriate to recalculate the parameters based on that data.

It is recognized that as our knowledge improves, the formulas used in calculating the climatic values could be modified as could the parameters themselves. This would be an evolving process and would not likely produce a major change in the relative climatic rating.

2. Soil and Landscape data requirements

Soil and landscape data are more site specific than the climate requirements and wherever possible should be collected in the field. This is particularly important for more detailed assessments. The definition and descriptions of individual parameters follow standards established by the national soils community. The assessor should refer to The Canada Soil Information System: Manual for describing soils in the field (Expert Committee on Soil Survey 1983) and the Canadian System of Soil Classification (Canada Soil Survey Committee 1978). Soil Taxonomy (classification) is not required but can be used as a surrogate for estimating many of the parameters used in the rating system.

For general capability assessments, particularly those of a regional nature, existing data may be used to markedly reduce field time. Soil survey reports and maps provide the most comprehensive set of soil and landscape data but data collected by other agencies such as Public Lands Division and Resource Evaluation and Planning Divison of Forestry, Lands and Wildlife, Land Classification Branch of Alberta Agriculture and the private sector should also be consulted where applicable.

Chapter III The Climate Factors

Climate is an integral part of the agricultural capability in Alberta. The indices developed for this evaluation reflect a concern for dryland agriculture, the common crops of the area and the summer growing season*.

The two principal variables are an energy factor and a moisture factor, the most limiting of which determines the basic climatic rating. Four modifiers; spring moisture, fall moisture, fall frost and hail, are also recognized as having an effect on the climatic assessment of agricultural capability.

Climatic data from over 200 stations were plotted and isolines drawn recognizing elevation and physiography. Extrapolation from stations was also aided by equations relating changes in energy and moisture to latitude, longitude and elevation. It must be stressed that climatic "lines" are in reality broad zones that average year-to-year variability. One in four year deviation (25% probability) maps for energy and moisture may be found on the maps of the moisture and energy factors.

The ratings were initially developed by calibrating the indices against benchmark areas. A comparison with the Agroclimatic Map of Alberta compiled by Bowser (1967)was included. A major test of the system was conducted using crop choice (percentage wheat, barley and canola) to define capability classes. The climate parameters and indices were then modified in accordance with the direction provided by the test and comments from provincial agronomists. A generalized map of the combined energy and moisture Classes (Fig.III-1) indicates the regional distribution of agroclimatic capability in Alberta.

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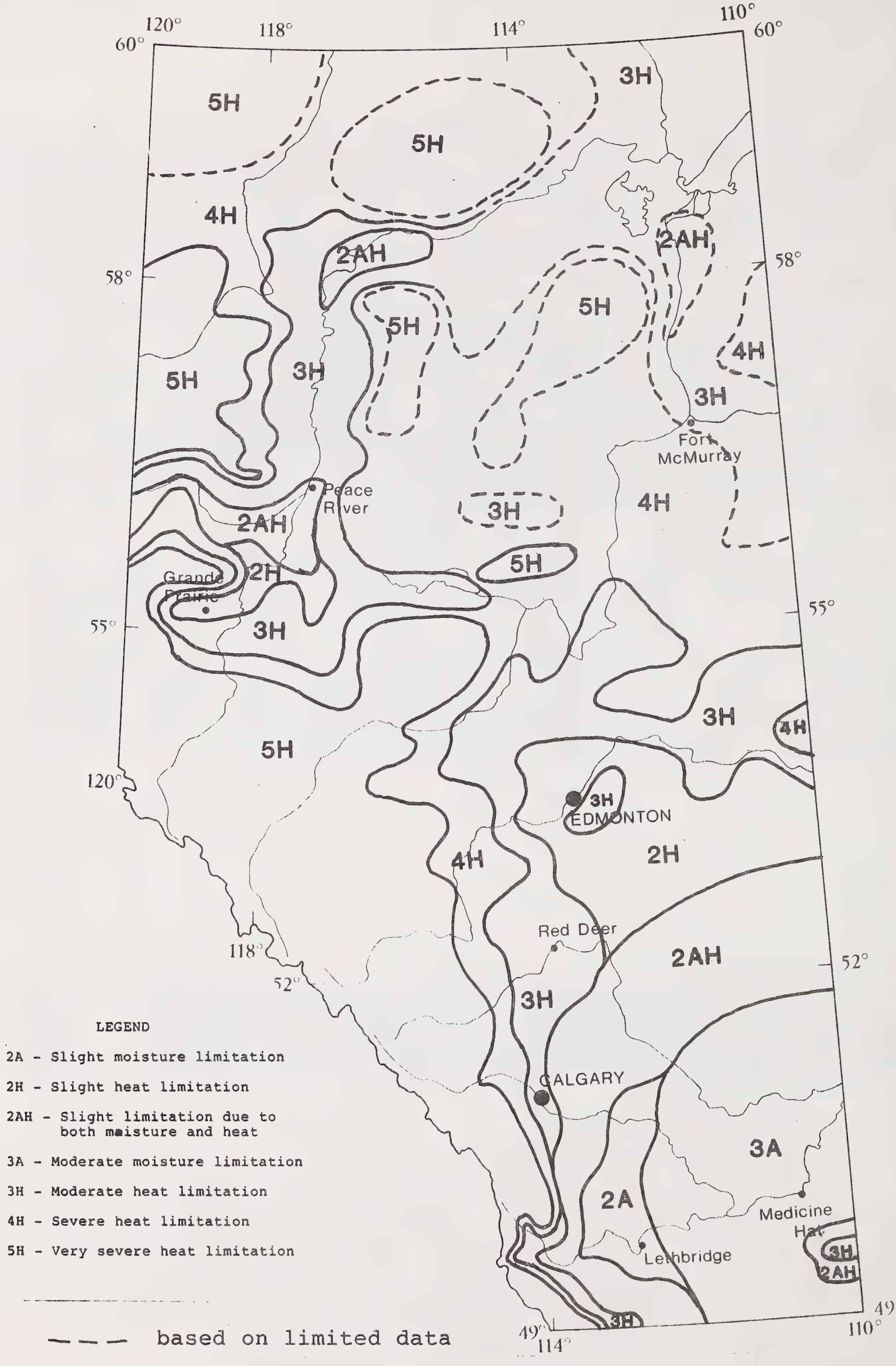
* A full discussion of the climatic considerations may be found in: Alberta Agrometeorology Advisory Committee. 1987. Agroclimatic classification for Alberta. Available from: Secretary, Alberta Agrometeorology Advisory Committee c/o Alberta Agriculture,Edmonton.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Fort McMurray
Peace River
3H
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2AH
2H
5H
Grande Prairie
3H
5H
3H
4H
3H
EDMONTON
2H
4H
Red Deer
2AH
3H
CALGARY
3A
2A
Medicine Hat
Lethbridge
3H
2AH
3H
LEGEND
2A - Slight moisture limitation
2H - Slight heat limitation
2AH - Slight limitation due to both moisture and heat
3A - Moderate moisture limitation
3H - Moderate heat limitation
4H - Severe heat limitation
5H - Very severe heat limitation
— — — based on limited data

Fig.III-1. Generalized agroclimatic classes for Alberta (Assuming no soil limitation)

A. Moisture Component (A)

The moisture component is a simplified moisture balance calculation based on monthly precipitation (P) and potential evapotranspiration (PE)(Baier and Robertson 1965). The monthly balances were weighted in accordance with general crop requirements such that:

(P-PE) index = 0.5(May) + 1.5(June) + 2.0(July) + 1.0(Aug)

The general distribution of the moisture index is shown in Fig. III-3. The larger scale map (in pocket) should be used with the rating guide (Fig III-2) for the climatic assessment.

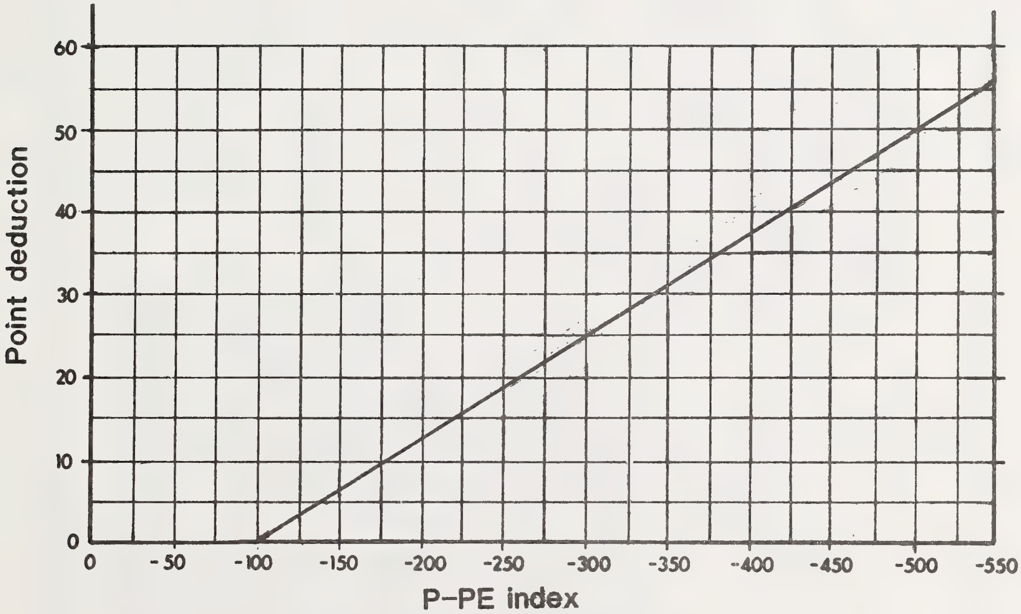
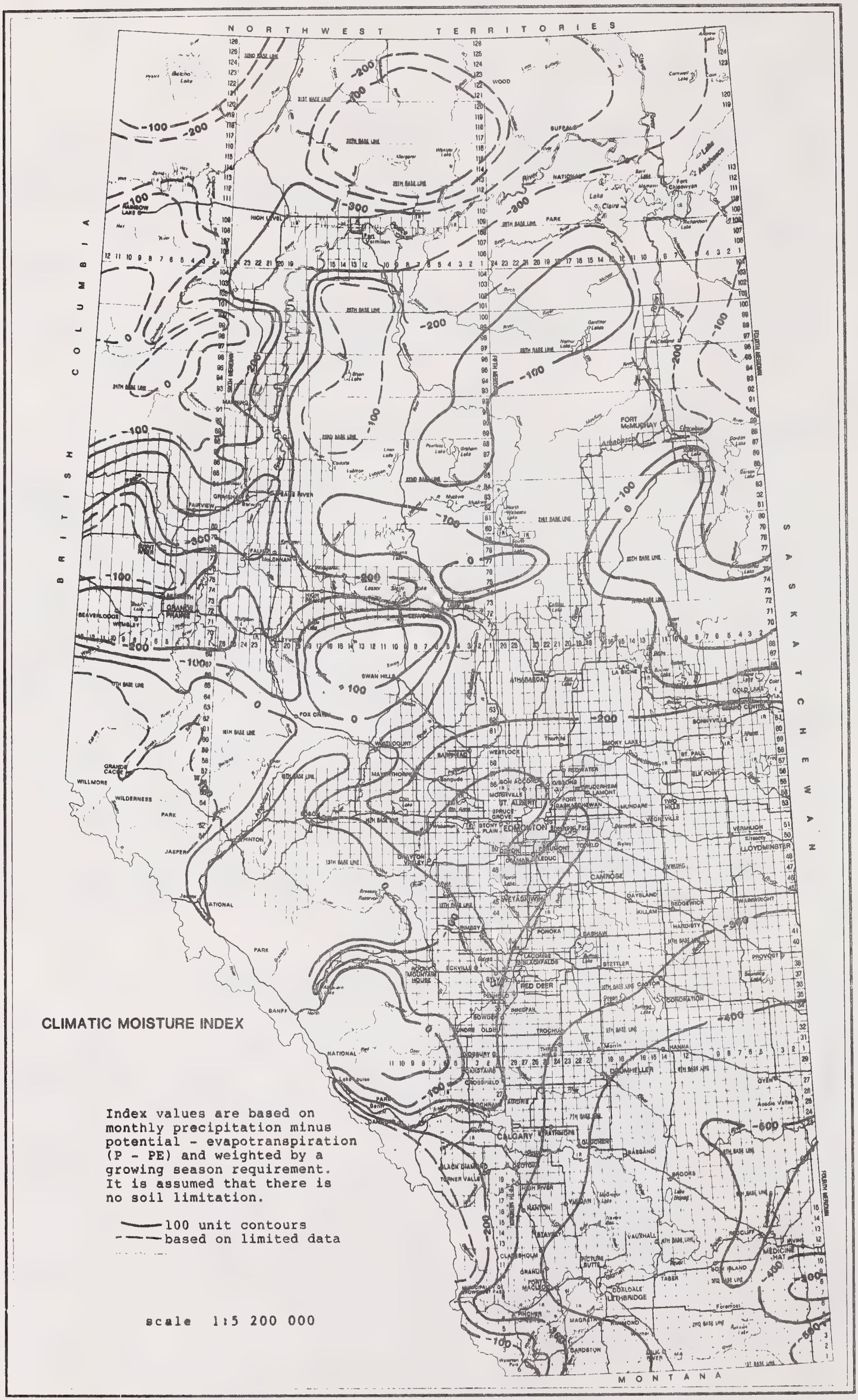


Fig.III-2.Point deductions for moisture index values.

The critical points considered in development of the rating, assuming no soil limitation, were:

a) P-PE < -100: Should be no limitation..............= 0 points
b) P-PE @ -300: Is close to the Black/Dark Brown soil zone boundary. This should be in class 2........... = 25 points
c) P-PE @ -400: Is near the point where one major crop (barley) is nearly excluded from the cropping system. It is also close to the Dark Brown/Brown soil zone boundary. This should be close to class 3 ....35-40 points
d) P-PE @ -500: Is the driest part of Alberta and should be near the bottom of class 3 ....50 points



Index values are based on monthly precipitation minus potential - evapotranspiration (P - PE) and weighted by a growing season requirement. It is assumed that there is no soil limitation.

Fig. III-3. Map of climatic moisture index.
(assuming no soil limitation)

B. Energy Component (H)

The energy component is based on an effective growing degree day (EGDD) calculation which includes length of season, degree days, day length and diurnal temperature range parameters.

The start of the growing season is taken as the first occurrence of five consecutive days with mean temperatures above 5 C after March 15. The end of the growing season is represented by the average date of first occurrence of 0 C after July 15. This is similar but not identical to frost free period. The starting date is an approximation of the soil temperature threshold for germination. The number of degree days over 5 C are accumulated over the season described above.

A major adjustment of the GDD value was introduced to recognize the effect of the longer day length in the north. The value of the modification varies from 1 at 49 degrees to 1.14 at 60 degrees N lat. An additional minor (+/-5%) adjustment recognizes daily temperature range.

The general distribution of the adjusted energy factor,now referred to as EGDD is shown in Fig. III-5. The larger scale map (in pocket) should be used with the rating guide (Fig. III-4) for the climatic assessment.

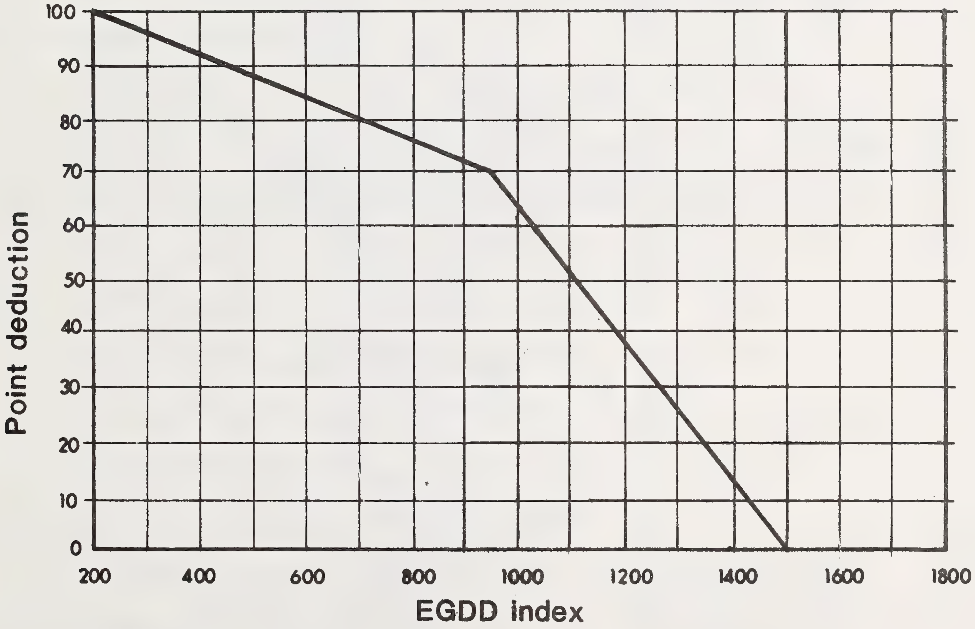
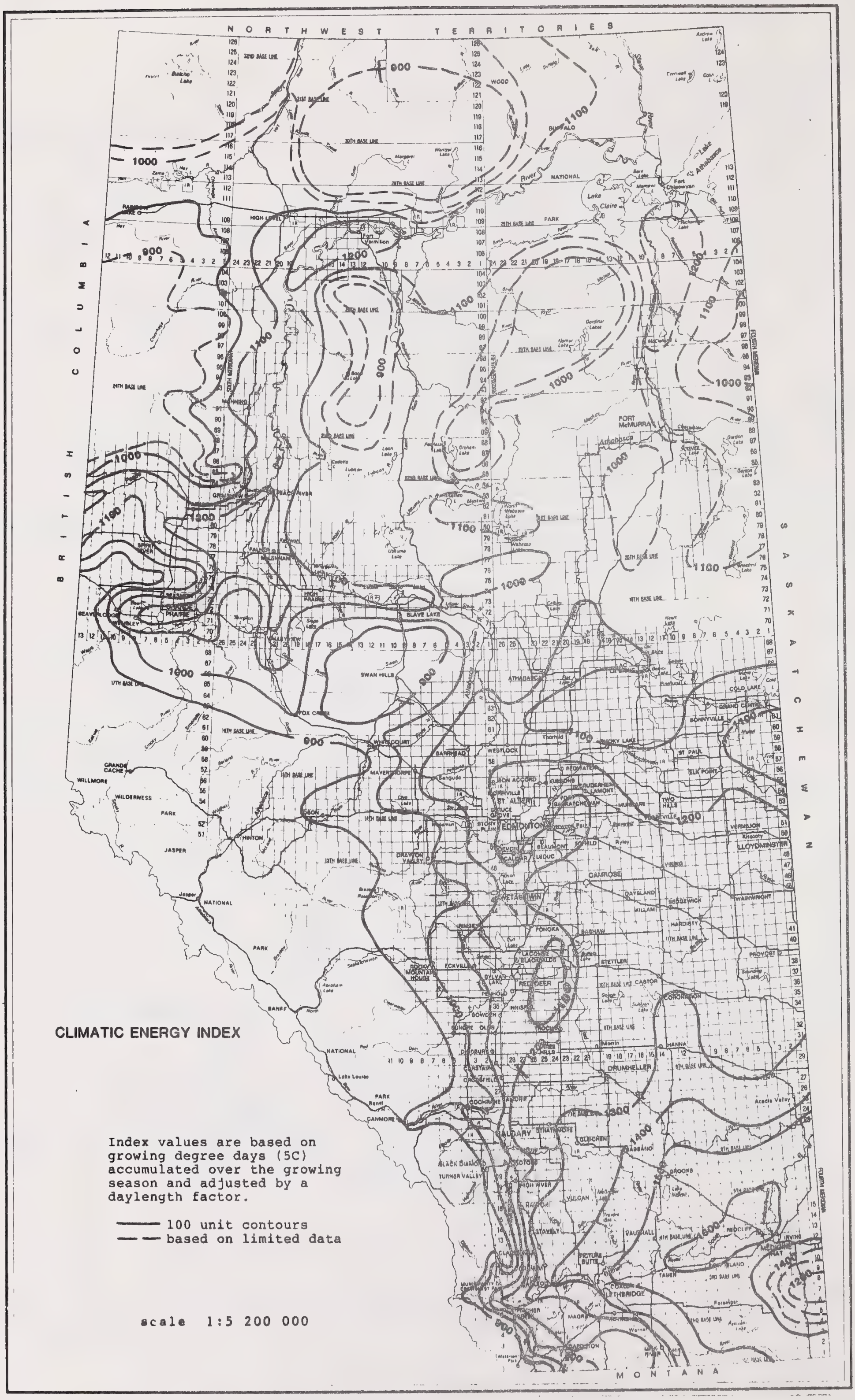


Fig. III-4. Point deductions for energy index (EGDD) values.

The critical points used for development of the rating were based on known crop requirements and Alberta farming experience.



CLIMATIC ENERGY INDEX

Index values are based on growing degree days (5C) accumulated over the growing season and adjusted by a daylength factor.

—— 100 unit contours

— — based on limited data

scale 1:5 200 000

Fig. III-5. Map of climatic energy index.

The points were:
a) 1500 EGDD:Should be no limitaion ....= 0 points
b) 1200 EGDD:This is close to the point where wheat drops to a minor component in a dominantly barley system. This should be class 3 ...~ 40 points
c) 1100 EGDD:This is near the point where annual crops occupy less than 50% of the cultivated area. This is close to marginal or class 4 ... ~ 50 points
d) 950 EGDD:This marks the edge of arable agriculture which should be class 5 .... = 70 points
c) 200 EGDD:Has no agricultural potential ....= 100 points

C. Modifying factors

Each of the modifiers was allowed a maximum 10% deduction.

1. Excess spring moisture.

This modifier was identified to recognize the effect of excess spring moisture in delaying seeding operations (and effectively shortening the growing season). It uses the (P-PE) index for May as the rating variable (Fig.III-6). A deficit of 50 mm was considered to be no problem and as excess of 50 mm was considered a major problem.

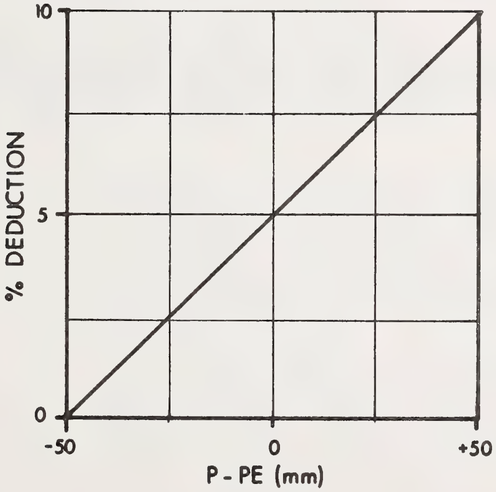


Fig.III-6. Percent deduction for P-PE (May).

2. Excess fall moisture.

This factor reflects the concern with harvesting. It uses the (P-PE)value for September as the rating variable but excludes soil factors that are also important. It is suggested that any excess moisture will cause a decrease in farming capability.

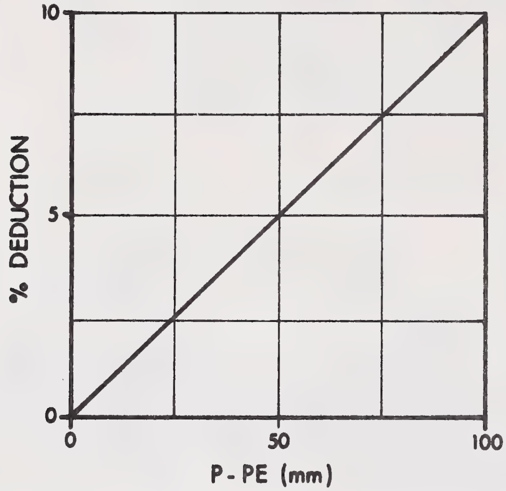


Fig. III-7. Percent deduction for P-PE (Sept).

3. Hail index.

This factor is based on the Alberta Hail and Crop Insurance Corporation hail index (1984).An index of 5 was considered as the base or threshold with the maximum index allotted the maximum deduction.

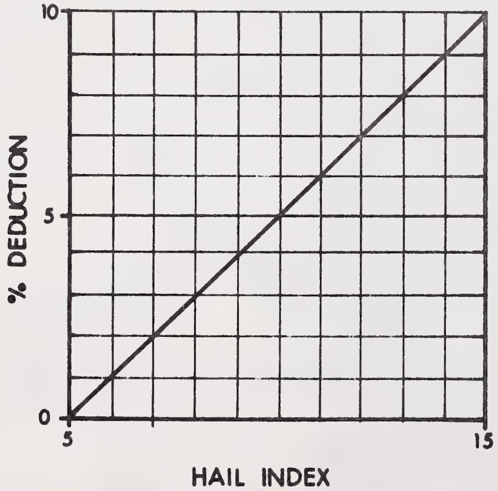


Fig. III-8. Percent deduction for hail index values.

4. Fall frost.

This is based on an estimate of the occurrence of frost prior to the regional average which is recognized in the H factor.

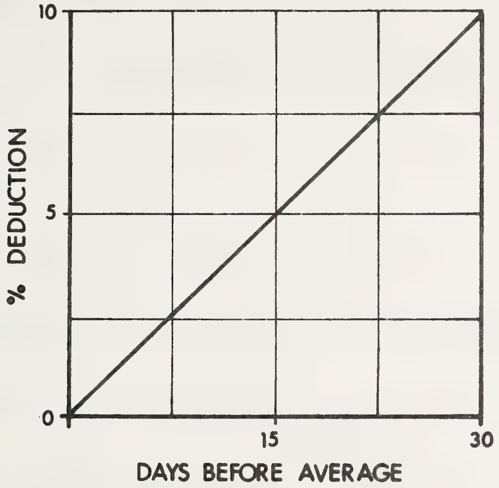


Fig. III-9. Percent deduction for early frost.

D. Calculation of the Climate Rating

The attached worksheet (Fig.III-10) should be used to facilitate the calculation. The following steps are suggested:

1. Locate the site on the enclosed climate moisture map (Map 1).
2. Estimate the moisture index (proportional from isolines) and enter in the value space on the worksheet.
3. With reference to Fig.III-2, assign the appropriate deduction.
4. Subtract deduction from 100 to determine the A rating.
5. Locate the site on the enclosed energy map (Map 2).
6. Estimate the effective growing degree days and enter on the worksheet.
7. With reference to Fig.III-3, assign the appropriate deduction.
8. Subtract deduction from 100 to determine the H rating.
9. The basic climate rating is the lowest of A or H.
10. For excess spring moisture, excess fall moisture and hail modifiers follow the same procedure as for A and H
    - locate site on map, estimate value, enter value and assign appropriate deductions using graphs III-6 to 8.
11. If values for fall frost are known, assign appropriate % deduction using Fig. III-9.
12. Total the modifier % deductions and multiply by the basic rating to determine the modification point deduction.
13. Subtract the modifier deduction from the basic rating to determine the Final Climate Rating.
14. You may wish to place the site into a capability class using the classification table (II-1).

You should at this stage also identify any factors which resulted in a 15 or greater point deduction and assign the appropriate subclass symbol. For example, a final rating of 75 with a 23 point deduction for moisture would be 2 A.

Climate (C)

factor	value	point deduction
1. Moisture component (A)		
P-PE index	________	________

A = 100 - ________ = ________

factor	value	point deduction
2. Energy component (H)		
EGDD index	________	________

H = 100 - ________ = ________

Basic Climate Rating is the lower of A or H = a)________

		point deduction
3. Modifiers		
-spring moisture	________	________
-fall moisture	________	________
-hail	________	________
-fall frost	________	________

modification deduction = ________ % of a) = b)________

FINAL CLIMATE RATING = a)______ - b)______ = ________

= Class ________, ________ subclass

Fig. III-10. Worksheet for climate rating.

NOTES

Chapter IV Factors for Mineral Soils

Mineral soils are those which have less than 40 cm of surface peat. Soils with over 40 cm of peat, organic soils, are discussed in chapter V.

The rating for mineral soils is considered in three parts, surface features (0-20 cm), subsurface features (20-100 cm) and drainage. Emphasis is placed on the surface 0-20 cm layer because it is the portion that is managed or cultivated. Also it is the portion where seeds are placed, seedlings develop and the majority of nutrients are found. The rating of the surface becomes the basic soil rating with the subsurface and drainage factors used as modifiers. The factors in the basic rating are assessed by point deductions, the modifiers as percent deductions.

A. Surface factors (0-20 cm depth)

Eight parameters are recognized for characterization of the surface 0-20 cm. They are texture, structure and consistence, organic matter, depth of topsoil, acidity, salinity, calcareousness and peaty surface. An additional factor, sodicity is suggested for reconstructed soils.

1. Texture (% sand, silt and clay): Subclass M

The amount of water available for plant growth is one of the major factors governing crop production. The principal controlling soil factor is texture, with some modification relating to organic matter content (see Appendix A). Another modifying factor is the coarse fragment content (gravel, stones, etc.). Material over 2 mm in size does not hold available water and therefore the water holding capacity should be reduced by an amount equivalent to the volume (%) of coarse material. The great majority of agricultural soils in Alberta have less than 5% coarse fragments so this factor is generally ignored. Further discussion of this factor may be found in Appendix A.

The amount of water available to plants is a function of the regional climate as well as soil factors. For example, the lower the average rainfall during the growing season the greater is the need for a large soil storage capacity and vice versa. This is reflected in the rating procedure which links the two factors (Table IV-1).

The climatic moisture factor (A) was indexed assuming no soil limitation. The following table puts the climate and soil factors together to give a combined rating (M) for moisture supplying capability.

Table IV-1. Deductions for moisture supplying ability based on surface soil texture and the climate A factor.

Climate (A)	Base	Texture								
P-PE index	rating	S	LS	SL	L	SiL	CL	SiCL	SiC	C
-100	0	45	25	0	0	0	0	0	0	0
-180	10	55	40	20	10	10	10	10	10	10
-260	20	65	50	35	25	20	20	20	20	20
-340	30	75	60	50	40	30	30	30	30	30
-420	40	85	70	60	50	45	40	40	40	40
-500	50	90	80	70	60	55	50	50	50	50
-540	55	90	80	75	65	60	60	55	55	55

The above table was developed around the following considerations.

a)Loam soil with P-PE index of -100 should have no deduction
b)Loam soil with P-PE index of -500 is marginal (Class 4) and was assigned a deduction of 60 points, and
c)Sandy soil with P-PE index of -100 should be class 3 = 45 points.

Table IV-1 also assumes the usual situation of a subsoil with the same or slightly finer texture than the surface (up to one class). Adjustments to the texture rating are recognized if the subsoil differs from the usual case. These adjustments apply only to the soil component of the primary rating and are most sensitive to the sandier textures (Table IV-2).

Table IV-2. Point adjustments for subsurface texture.*

average	Surface texture				
subsoil texture**	S	LS	SL	L	SiL - C
S	0	+5	+15	+25	+25
LS	-5	0	+5	+15	+20
SL	-15	-5	0	+5	+10
L	-25	-10	-5	0	+5
SiL-C	-30	-15	-10	-5	0

** Average for 20 cm to 100 cm assumed to account for 2/3 of the available moisture.

* This table should not be used if the difference between the surface and subsurface textures is less than 10 points in Table 1.

2. Structure and Consistence: Subclass D

Structure, the aggregation of soil particles, is important from water infiltration, aeration and workability considerations. It is related to texture and organic matter content and is described in terms of the size and shape of aggregates. An associated term is consistence, the resistance to crushing, which is dependent on moisture content. A closely related physical measurement is bulk density or compactness. The relationships between structure, consistence, texture, bulk density and deductions for plant growth are described more fully in Appendix A. The following table was constructed using those relationships.

Table IV-3. Point deductions for surface soil structure and consistence classes.

Structure	Consistence moist/dry	Points deducted
granular, subangular or fine blocky	friable, slightly hard	0
blocky, platy or single grained	firm/loose; hard/lose	5
massive	very firm; very hard	10

For peaty surfaces see Section 9.

This factor is restricted to a maximum 10 point deduction in the surface soil rating because management can modify surface features in cultivated soils.

3. Organic matter: Subclass F

Organic matter is a very important component of agricultural soils, contributing to the nutrient pool (mainly nitrogen), structure and workability and water holding capacity. Soil quality deteriorates quickly at organic matter levels below about 2%. While a very important factor, the maximum deduction is limited to 15 points because management inputs can result in major modifications to organic matter content.

Organic content can be measured in the laboratory or it can be estimated by soil color. The value component (the darkness or gray component) of the Munsell Soil Color notation correlates quite well with percentage organic matter and is used as the basis for the following table.

Table IV-4. Deductions for surface organic matter content.

% Organic Matter Ah/Ae*	 Ap*	Dry Munsell value	 color	Point deduction
>6	>6	2/x	black	0
>6	4-5	3/X	black	0
4-5	3	4/X	dark brown	2
			dark gray	2
3	2	5/X	brown; gray	5
1	1	6/X	gray	10
<1	<1	7/X	light gray	15

* Standard soil horizon designations - see glossary
Ap is a cultivated horizon.

If the Ah (mineral organic) horizon is less than 5 cm thick the color of the underlying horizon is used to determine the point deduction. However, if the Ah is 2-5 cm thick the value of the underlying horizon may be raised 1 unit. For example, if a 4 cm Ah is underlain by an Ae with a value of 7/x then it would be appropriate to use a value of 6/x when calculating the point deduction.

4. Depth of topsoil (Ah or Ap horizon): Subclass E

This is the darker colored surface horizon (Ah undisturbed, Ap cultivated). It contains more organic matter and generally has a more favourable structure than the subsoils. The depth at which the subsoil occurs is directly related to plant growth and ease of management. The kind of subsoil is also important. The following guidelines (Table IV-5) have been developed.

Table IV-5. Point deductions for depth of topsoil (Ah/Ap horizon).

Type of subsoil	Depth of topsoil (Ah/Ap horizon)(cm) 20	 15	 10	 5	 0
Favourable - friable or slightly hard - Bm or Btj horizons*	0	0	2	5	10
Unfavourable - very firm, hard, massive, or strongly calcareous - Bt, Bnt, Ae or Cca horizon*	0	5	10	15	20

* Standard soil horizon designations - see glossary

For Ah horizons (uncultivated soils) less than 5 cm thick and for Ap horizon (cultivated soils) with Munsell values of 6 or lighter, the 0 cm depth column should be used.

5. Acidity/Alkalinity: Subclass V

A neutral to slightly acid condition is the ideal situation for a balanced nutrient supply. As soils become more acidic than pH 5.0 there is a depression of yield and at values below about pH 4.0 some elements may be present in toxic quantities. Crops differ markedly in response to acidity with oats being the most tolerant and wheat the least of the small grains. A pH 5.5 will affect alfalfa growth.

A high pH or alkaline condition can also affect plant response but this situation is usually associated with saline or sodic conditions (see sections 6 and 7 for discussions of salinity and sodicity). Values above 8.5 only occur if there is a relatively high sodium content associated with a generally low lime content. This situation is rare in Alberta under natural conditions. If a deduction is made for salinity or sodicity no deduction will be made for high pH values (double counting).

There are several common methods for determining pH: saturated paste (water), 1:2 soil-water suspension and 1:2 soil - 0.01 M CaCl2. Compared to the saturated paste, the CaCl2 pH is usually about 1/2 unit lower in value and the 1:2 water slightly higher. It should be kept in mind that seasonal variation in soil pH is often in the order of 1/2 unit.

The rating assessment (Table IV-6) was developed from the following considerations:

a) pH 5.5 is a slight limitation --------------- 5 points
b) pH 4.0 is a severe limitation (class 4) ----- 55 points
c) pH 3.0 no value for agriculture ------------ 100 points

Table IV-6. Point deductions for surface soil pH as measured in a saturated paste.

Soil pH*	Points deducted
9.0	60
8.5	20
8.0	5
6.5-7.5	0
6.0	2
5.5	5
5.0	15
4.5	30
4.0	55
3.5	80

* Measured in saturated paste. Add 0.5 units to pH values measured in CaCl2.

6. Salinity: Subclass N

This refers to the presence of excessive amounts of soluble salts such as magnesium sulphate. Salinity affects crop growth in two ways. There are chemical effects, but the presence of salts also makes it more difficult for plants to take up water. As moisture is a limiting factor in much of the farming area in Alberta this becomes an important consideration.

Salinity, expressed in terms of electrical conductivity, can be measured in the field or laboratory, or it can be estimated from soil and vegetation characteristics. Crops vary appreciably in salt tolerance, barley being generally more tolerant than others, but effects become noticeable at an E.C of about 4 and moderate to severe by an E.C. of 8. There is very little crop growth at an E.C. of 16. Table IV-7 was developed from these relationships.

Table IV-7. Point deductions for surface soil salinity.

Salinity* (dS/m)	Common features	Points deducted
2	- no apparent signs - affects sensitive crops	0
4	- presence of foxtail - some white specks on soil surface - crop growth affected to some extent	20
8	- plants restricted to salt tolerant species (eg. Kochia) - white salt crusts common - crops strongly affected	50
16	- plants restricted to species such as red samphire - salt crust and salts throughout profile - little or no crop growth	90

* Measured in saturated paste.

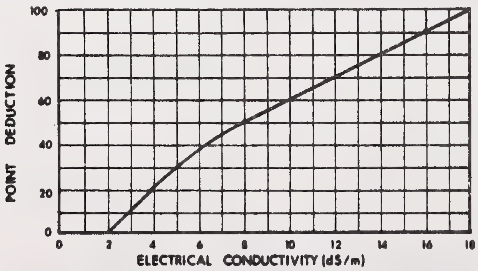


Fig. IV-1. Relationship between point deductions and electrical conductivity.

7. Sodicity and Saturation Percentage: Subclass Y.
(This factor is only recommended for reconstructed soils.)

As the percentage of sodium on the soil exchange increases over about 15% (usually associated with a pH over 8.5) the stability of soil aggregates decreases markedly. The finer soil particles, clays and organic matter, become dispersed resulting in adverse physical conditions, i.e. massive and sticky when wet and extremely hard when dry.

The influence of sodium is often expressed in terms of the sodium adsorption ratio or SAR. A closely associated feature in soils of loam texture or finer is the saturation percentage, the volume of water required to make a saturated paste. In the evaluation of this factor it is recommended that the most limiting of the two measurements be used (Table IV-8).

Table IV-8. Point deductions for surface soil sodicity and saturation percentage.

Sodicity (SAR)*	Saturation percentage (Sat %)	Points deducted
4	60	0
8	80	10
12	120	30
16	160	50
20	>160	80

* SAR = sodium adsorption ratio (see glossary for definition)

8. Calcareousness: Subclass K

The occurrence of free lime (CaCO3) has a similar effect as salt in that it inhibits the plant availability of water. It may also affect the availability of some nutrients, especially phosphorous. Lime is separated from other salts (Section 6) because it is less soluble, seasonally less variable and less dramatic in its effect on plant growth.

It can be measured in the laboratory or estimated from the reaction with dilute acid as illustrated in Table IV-9.

Table IV-9. Point deductions for surface calcareousness.

% CaCO3 (lime)	Reaction to 10% HCl	Points deducted
2*	very weak-barely observable	0
5	moderate-bubbles to low foam	5
10	strong-thick foam	10
25	very strong-violent reaction	30

* A lime amendment of 25 tonnes/ha (10 tons/ac) would result in about 1% CaCO3 in the top 20 cm.

9. Organic (peaty) surface: Subclass 0

Organic surfaces, when cultivated, present special management problems which are related to the degree of decomposition of the peat and the depth of organic material. The well decomposed (dark colored, mesic to humic, sedge) peats which are generally well compacted and have a granular structure are the most favourable. The least favourable are the raw (light colored, fibric, moss) peats which are quite porous. Mesic materials have characteristics between the other two.

Peaty (surface peat) mineral soils grade to Organic soils (deep peat) when the depth of peat exceeds 40 cm (60 cm if all fibric). However, depths are not always easy to establish particularly when cultivation results in an immediate compaction of the deposit. In general mesic peats will compact about 30% and fibric peats about 40%. Therefore the maximum depth of cultivated or compact peat to be considered in this section is about 30 cm (40 x 0.7, 50 x 0.6). Anything deeper will be discussed under Organic soils (Chapter V). With these guidelines the following table (Table IV-10) was developed.

Table IV-10. Point deductions for organic (peaty) surfaces.

Depth of Peat (cm)* non-compact	compact	Degree of decomposition	General structure	General consistence	Points deduction
15	15	humic	compact	friable	10
20	15	mesic			15
25	15	fibric	spongy	fibrous	20
30	30	humic	compact	friable	20
40	30	mesic			30
50	30	fibric	spongy	fibrous	40

* depths of less than 10 cm should be handled as mineral soils.

NOTE: when rating for a peaty surface the mineral ratings for texture, structure and organic matter are not used.

B. Subsurface factors (20-100 cm depth)

Subsurface factors, while important, are considered as modifiers to the surface rating. As with modifiers in other section, they are managed as percentage reductions of the primary rating. The depth of 100 cm was chosen on the assumption that it represented the effective rooting zone for most annual crops.

Five factors are recognized in this category. They are texture, structure and consistence, depth to a nonconforming layer, acidity and salinity. An additional factor, sodicity, is suggested for reconstructed soils. Subsoil texture, however, has been addressed in conjunction with surface texture in part A and will not be discussed further here.

1. Subsoil structure and consistence: Subclass D

Structure and consistence (and density) affect root penetration and therefore the availability of water and nutrients to the plant. Solonetzic (sodium salt affected) soils are particularly poor in this regard but fine textured Luvisolic (wooded) soils may also provide some restriction to plant growth. See Appendix A for a description of the general relationships between structure, consistence, texture, kinds of horizons, bulk density and deductions for plant growth. The following rating (Table IV-11) was developed from those relationships.

Table IV-11. Percent deduction for subsoil structure and consistence.

Structure	Consistence	Common* horizons	Percent deduction
prismatic, fine blocky, platy	friable slightly hard	Bm,Btj,Bf Ae,Ck	0
blocky, prismatic	firm hard	Bm(clay),Bt Btnj	10
blocky, columnar	very firm very hard	Bnt(So,SS)	30
columnar, massive**	very dense very compact	Bn,Bnt (SS,Sz)	50

* Standard soil horizon designations (see Glossary)
So=Solod, SS=Solodized Solonetz, Sz=Solonetz

** If a paralithic contact (see B2 and Glossary) is also present use the most limiting but not both parameters.

2. Depth to nonconforming layer: Subclasses R,D or M.

A nonconforming layer indicates a change in material. It is a geologic rather than a pedologic or soil forming feature. This factor, like structure and consistence, is important in terms of water movement and root penetration. Various layers have been recognized based on density (hardness) and contrasting textures. Textural changes may be harmful or beneficial depending on the nature of the material and its relationship to water availability.

Table IV-12. Percent deductions for depth to various non-conforming layers.

Kind of layer	Depth to contact(cm)	Percent deduction
lithic*: subclass R	100	10
	50	50
	20	90
paralithic*: subclass D	100	0
	50	30
	20	50
loam or finer over gravel or gravel and sand: subclass M	100	0
	50	30
	20	50

* Lithic is not penetrable by roots,
Paralithic is severely restraining but not impenetrable.

3. Subsoil acidity: Subclass V

Subsoil pH levels have the same kind of effects on nutrient availability and plant growth as in the surface layer. Alkaline reactions are generally a problem only if associated with salinity and sodicity which will be dealt with in B-4 and B-5 so this section will consider only acid reactions. Because the majority of Alberta soils are developed from calcareous parent materials it was felt that the 20-60 cm depth was most critical and should serve as the basis for this factor. It was felt that the impact of specific pH levels would be less severe than in the surface layer (A-5).

Table IV-13. Percent deductions for subsoil acidity.

Subsoil pH*	Percent deduction
6.0	0
5.5	2
5.0	5
4.5	15
4.0	30
3.5	55

* Measured in saturated paste. Add 1/2 unit to pH values measured in CaCl2.

4. Subsoil salinity: Subclass N.

A subsoil salinity deduction should only be made if the limitation is more limiting than the surface condition.

Table IV-14. Percent deduction for subsoil salinity.

EC(dS/m)*	Percent deduction
<4	0
4	10
8	20
12	40
16	70

* Measured in saturation extract.

5. Subsoil sodicity and saturation percentage: Subclass Y. (This factor is only recommended for reconstructed soils)

This factor should be only considered in the case of reconstructed soils. Subsoil sodicity (as measured by SAR) and saturation percentage are evaluated only if they are more limiting than the surface sodicity or saturation percentage (see Section A7). If point deductions for subsoil sodicity and saturation percentage are equal or less than the point deductions for surface sodicity and saturation percentage, the subsoil is not evaluated. As with the surface evaluation, this factor should not be used for soils with a texture coarser than loam. The average SAR and Sat % for the 20-100 cm depth is considered in determining subsoil SAR and Sat%. Only the most limiting (most point deductions) of SAR or Sat % is considered. To avoid excess deduction points for related soil parameters, point deductions are only made for SAR or Sat % if the limitation is more severe than the subsoil salinity limitation (see Section B-4).
Table IV-15 indicates the percent point deductions for the various sodicity (SAR) and saturation percentage classes.

Table IV-15. Recommended percent deductions for subsoil sodicity and saturation percentage.

Sodicity (SAR)*	Saturation percentage (Sat %)	Percent deduction
4	60	0
8	80	10
12	120	30
16	160	50
20	>160	80

* SAR = sodium adsorption ratio (see glossary for definition).

C. Drainage: Subclass W

Drainage in this context refers to site specific evaluations (as compared to the broader landscape context). The rating is based on not only the plant growth aspects but also the ability to manage the land. The main factor considered is the height of the water table for a minimum of one month during the growing season. It is not always practical to make the physical measurements necessary to determine the water characteristics, but there are soil and vegetation features which can be used to estimate the drainage factor (Table IV-16).

Drainage, like the subsoil factor, is considered as a modifier to the surface soil rating and is therefore managed as a percent deduction.

Table IV-16. Percent deductions for soil moisture regime.

Water table depth (cm) (min of 1 mo.)	Common drainage class	Soil/vegetation	Percent deduction
surface for 4 months	very poorly	ponded water	100
surface	very poorly	gleysolic soils sedges, slough grass, willows	85
20	poorly	gleysolic soils sedges, willows; - can hay every year cultivate occasionally	70
50	imperfectly	gleyed soil (mottling below 50 cm) lush growth of poplar, white spruce, willows.	
		- can cultivate 6 out of 10 years	40
		- can cultivate 9 out of 10 years	10
100	moderately well	may have some gley features in subsoil lusher vegetation growth than surrounding landscape	0

The drainage factor can be assessed for any designated condition, but if it is a state other than the present it should be so indicated. The present assessment should also be given.

The fact that soil features respond slowly to changes in the drainage regime can also complicate the assessment of this factor.For example, drained soils may maintain gley features for many years. In these cases the rating should be based on any continuing limitation and not on soil morphology.

D. Calculation of the mineral soil rating (S).

The attached worksheet (Fig. IV-3) should be used to facilitate the calculation. The following steps are suggested:

1. Examine the soil (or supplied information) and fill in the "value" for each parameter. For example, texture = sandy loam; organic matter = dark gray color; depth = 15 cm, etc.

2. Look up the moisture deduction component (A) from the climate calculation, locate it on the texture chart (Table IV-1) and determine the appropriate texture deduction. If the climate calculation has not been done then the P-PE index value must be found by locating the site on the moisture climate map.

3. Determine the subsoil texture and using Table IV-2 assign the appropriate adjustment for a final texture rating.

4. Using the tables or charts in this section assign the appropriate penalty points to the factors. For example, assuming a location in the Edmonton area, the above parameters could have values of 25, 2 and 0 points respectively.

5. Total the points for the surface factors and subtract from 100 to give the basic rating (a).

6. Determine the "values" for the subsoil factors.

7. Assign appropriate percentage deductions.

8. Total the percentages and multiply by the basic rating to give the subsoil deduction (b).

9. Basic rating - subsoil deduction = interim soil rating (c).

10. Determine the drainage value.

11. Assign the appropriate percent deduction.

12. This percent of the interim rating (c) gives the drainage deduction (d).

13. The basic rating - (subsoil & drainage deductions) = the final soil rating.

14. You may wish to place the soil into a capability class using the classification table (II-1). You should at this stage also identify any factors which resulted in a greater than 15 point or percentage deduction and assign the appropriate sub class symbol. For example a final rating of 65 with a 20 point deduction for structure would be 2 D.

Note: If texture results in more than a 15 point deduction over the climate base use M, otherwise use A.Do not use both.

MINERAL SOIL (S)

factor	value	point deduction
1. Surface Factors (point deductions)		
- texture (M)	__________	
- subsoil texture	__________	_______
- structure and consistence (D)	__________	_______
- organic matter (F)	__________	_______
- depth of Ah or Ap (E)	__________	_______
- acidity (V)	__________	_______
- salinity (N)	__________	_______
- sodicity/saturation % (Y)	__________	_______
- calcareous (K)	__________	_______
- peaty surface (O)	__________	_______

Basic Soil Rating = 100 - _______= a)______

		percent deduction
2. Subsoil Factors (percent deduction)		
- structure and consistence (D)	__________	_______
- depth to nonconforming layer (R, D or M)	__________	_______
- acidity (V)	__________	_______
- salinity (N)	__________	_______
- sodicity/saturation % (Y)	__________	_______

Subsoil deduction = _______% of a)

= b)_______

Interim Soil Rating = a)_______- b)_______ =c)_______

3. Drainage Factor (percent deductions)		
- drainage (W)	__________	_______

Drainage deduction = _______ % of c)

= d)_______

FINAL SOIL RATING (S) = a)_____ - [b)_____+ d)_____] = ______

= Class _______, ____ ____
subclasses

Fig.IV-2. Worksheet for mineral soil rating.

NOTES

Chapter V Factors for Organic Soils

Organic soils are those which have greater than 40 cm of peat (greater than 60 cm of fluffy fibric peat). They present special problems due to material (bulk density, water supplying capacity, fertility) and landscape position (drainage, climate). Some of the considerations are similar to those for mineral soils but many such as drainage and pH are different.

In Alberta, the kind of arable agriculture practiced on organic soils is an extension of that on mineral landscapes - small grains and oil seeds. Under these conditions organic soils are a limitation and deeper deposits are more limiting. This is different from an interpretation for vegetable production where the producer wishes to maintain the organic growing medium and the rating system described here reflects that difference.

As with the treatment of mineral soils, the organic rating is divided into 3 parts, surface features (including temperature), subsurface featues and drainage. The surface rating becomes the basic rating determined by point deductions with the subsurface and drainage components used as percentage modifiers.

Peat materials will compact under drainage and cultivation and comparisons based on undeveloped conditions make depth descriptions difficult. For consistency, a "compacted" depth is used as a standard reference in this report. Following are some guidelines for estimating compact equivalents.

Table V-1. Approximate settlement of different peat materials.*

Relative density	Degree of decomposition (fibre content)	Approximate settlement
very loose	fibric	40%
loose	fibric-mesic	30%
rather dense	mesic	20%
dense	humic	15%

* Adapted from Parent (1981)

Table V-2. Equivalent depths of compact and non-compact peats.

Compacted peat (cm)	Equivalent non-compacted mesic	fibric
40	50	70
80	100	130
120	150	200

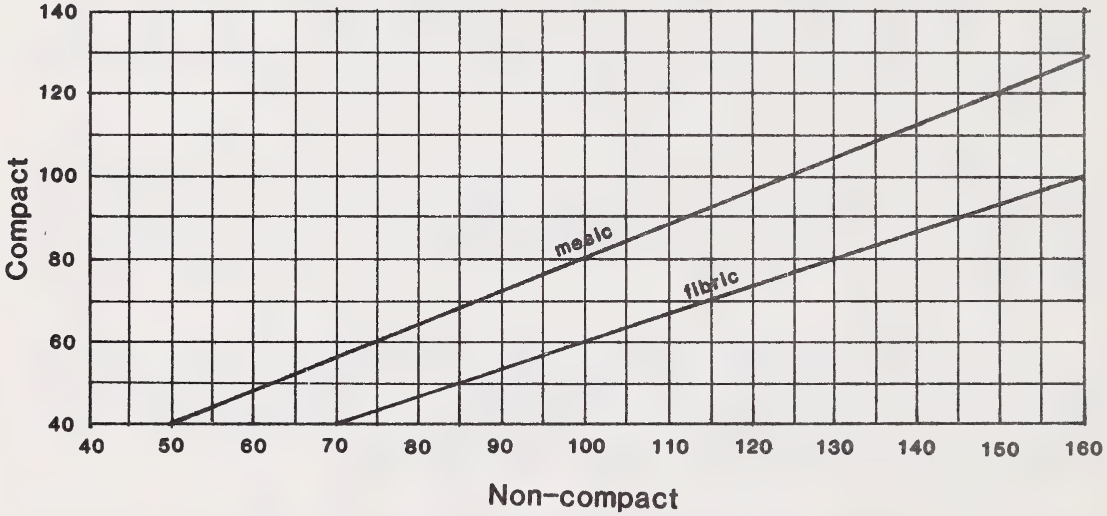


Fig. V-1. Equivalent depths of compact and non-compact peats.

A. Surface factors (0-40 cm depth)

The top 40 cm of compacted peat is considered for the base rating. Forty cm is suggested, rather than 20 cm such as used for mineral soils, in recognition of the settlement and mineralization that takes place in organic soils. In more temperate climates decomposition rates from 2 to 5 cm per year have been suggested. In our cooler climate the rate will be slower but even 1 cm per yer would reduce the level 20 cm in 20 years. Four factors are rated for their contribution to management, seed establishment and growth. These are soil climate, particle size distribution, nutrient status and pH, and salinity.

1. Organic soil climate: subclass Z

The organic soil rating, like the mineral soil rating, recognizes and is linked to the regional climatic setting; in this case through the energy (thermal) factor.

Organic soils occur in a variety of ecoclimatic regions with energy inputs ranging from over 2000 to less than 200 Growing Degree Days (5°C). Organic materials have different thermal characteristics than mineral soils which result in cooler soil temperatures, particularly in the spring and more particularly in the cooler climates (Mills et al 1977, Levesque & Mathur 1985). It is suggested that a maximum of 15 points be assessed using the following energy relationship.

Table V-3. Point deductions for climatic regime.

Heat units (EGDD)*	Organic soil deduction
1600	0
1500	5
1400	10
1300	15

* above 5°C

2. Particle size distribution

Organic material is described in terms of fibre content or degree of decomposition and wood content. This is analogous to texture in mineral soils and controls permeability as well as workability of an area.

2.1 Degree of decomposition: subclass B

This relates to the fibre content on the peat material and reflects both the degree of decomposition and the kind of source material. Peats developed from sedges, for example, will generally have lower fibre contents than those developed from sphagnum mosses. The definitions of humic, mesic and fibric (see Glossary) refer to the less than 10%, 10% to 40% and over 40% rubbed fibre contents. Degree of decompositon can also be estimated using the von Post humification scale (see Glossary) which can be correlated with the rubbed fibre content (Fig. A-1).

Table V-4: Point deductions for degree of decomposition.

Fibre content	Fibric >60% fibre von Post 1&2	Fibric 40-60% fibre von Post 3&4	Mesic 10-40% fibre von Post 5-7	Humic <10% fibre von Post 8-10
deduction	20	15	10	5

In Alberta the coarse fibric peats are usually sphagnum derived, light brown and spongy or loose. The mesic peats commonly are dark brown, somewhat felted, rather dense and derived in large part from sedges.

2.2 Wood content: Subclass I

This parameter is equivalent to the coarse fragment (stone) content in mineral soils. It is primarily a development/ management concern. Only fragments greater than 10 cm are evaluated.

Table V-5. Point deductions for surface wood content.

Wood content (% by volume)	Comments	Point deduction
<1	v. low	0
2	low	5
5	moderate	10
10	high (forest)	25

3. Nutrient Status: Subclass G

Organic soils can have a wide range in nutrient status. It is correlated to a large degree with the source of water. Those areas receiving water mainly from surrounding mineral soils or from groundwater usually have a near neutral pH and relatively higher nutrient contents (eutrophic). Those areas where the water at the surface of the organic deposit is primarily derived from precipitation are usually more acidic and are generally nutrient poor (oligotrophic). In nearly all cases organic soils have special fertilizer requirements. Potassium need is universal and micronutrients deficiencies are common particularly in the more acidic environments (Lucas 1982).

There is a correlation between fertility and acidity but it is not confined to a single effect. One is the effect of pH itself, another is the change in availability of nutrients at different pH levels and a third is the correlation of pH with the source and nutrient status of water.

Another aspect of fertility revolves around the relationship between nutrient content, origin of material and degree of decomposition. Again it is not a simple correlation but one which also involves water source and pH. Very broadly speaking the raw sphagnum peats have high fibre content, high C:N ratios, low pH, and low nutrient contents. On the other hand moderately well decomposed sedge peats commonly have low fibre contents, lower C:N ratios, more neutral pH, and a better supply of nutrients.

It is recognized that there are inherent dangers in over simplification but it appeared that there could be even more problems if each of the above factors was evaluated separately without recognizing any interaction. Therefore, the following table is suggested for a nutrient status (fertility) rating.

Table V-6. Point deduction for nutrient status.

	Kind of material			
pH*	mainly mosses Fibric >60% fibre	Fibric 40-60% fibre	Mesic 10-40% fibre	Humic <10% fibre
5.5 +	20	15	10	5
5.0	25	20	15	10
4.5	30	25	20	15
4.0	40	35	30	25
3.5	50	45	40	35

* Measured in saturated paste. Add 1/2 unit to pH values measured in CaCl2.

4. Salinity: Subclass N

Saline organic soils are rare in Alberta. Should they be encountered the same limitations would apply as for mineral soils (Table V-7).

Table V-7. Point deductions for surface salinity.

Salinity (dS/m)*	Point deductions
2	0
4	20
8	50
16	75

* Saturation extract or equivalent.

B. Subsurface factors (40-120 cm)

Subsurface factors are considered as modifiers of the surface (base) rating and as such are managed as percentage reductions. The depth is taken as the depth of organic material up to a maximum of 120 cms. This is 20 cm greater than for mineral soils because of the deeper surface horizon defined to recognize subsidence in these soils.

Five factors are recognized in this category. They are depth of deposit and kind of substrate, particle size distribution, acidity and salinity.

1. Depth of deposit: Subclass X

Depth to and kind of substrate are key considerations in water control and other management decisions. If the organic material is removed or mineralized then the underlying material must be considered. A medium textured material capable of drainage and with a humic surface would be best. Sands or highly reduced tight lacustrine (blue clay) materials would be less desirable. With these considerations in mind the following rating (Table V-8) was developed.

Table V-8. Deductions for depth of peat and kind of substrate.

Compacted depth	Texture of substrate	Percent deduction
	sandy	10
40	loamy	0
	clayey	10
	sandy	30
80	loamy	20
	clayey	30
	sandy	50
120	loamy	50
	clayey	50

* If the substrate lacks a dark colored humic horizon deduct an additional 10 percentage points at the 40 cm depth and 5 points at the 80 cm depth.

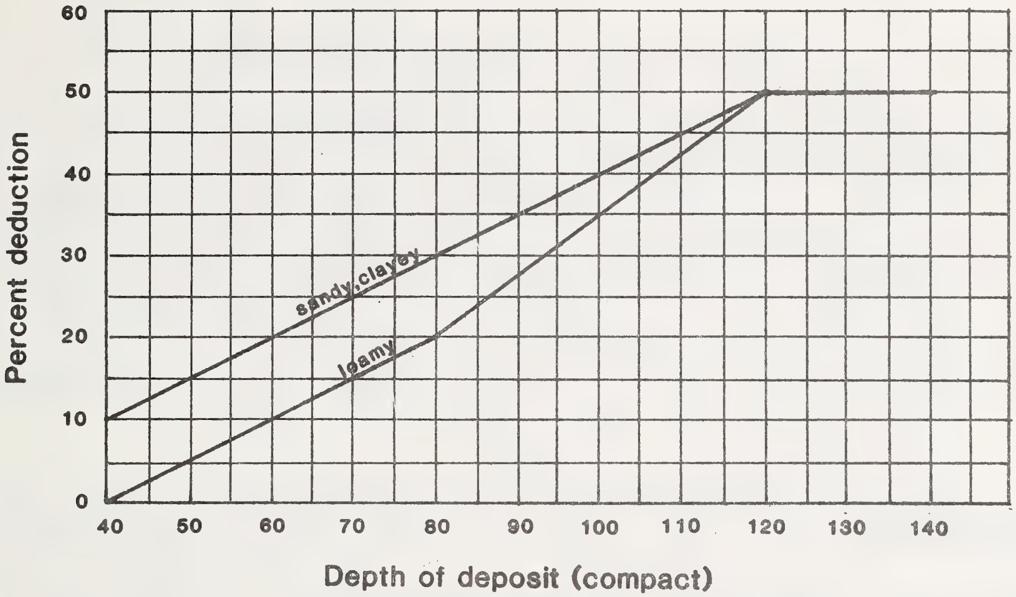


Fig. V-2. Deductions for depth of peat and kind of substrate.

2. Particle size distribution

Again two aspects, fibre content and wood content, are considered.

2.1 Degree of decomposition: subclass B

This should be an average for the organic material from 40 cm to base of deposit or 120 cm whichever is less.

Table V-9. Deduction for subsurface degree of decomposition.

Fibre content (decom-position)	Fibric >60% fibre von Post 1&2	Fibric 40-60% fibre von Post 3&4	Mesic 10-40% fibre von Post 5-7	Humic <10% fibre von Post 8-10
deduction	10	5	0	10

2.2 Wood content: subclass I

Subsurface wood content is less restrictive than surface wood. It can be estimated by exposing a profile (% by volume) or by probing. Again only those inclusions over 10 cm in diameter should be considered.

Table V-10. Deductions for subsurface wood content.

Wood content % by volume	 % probes	Percent deduction
2	20	0
5	40	5
10	80	10
25	100	25

3. Subsurface acidity: Subclass V

Subsurface acidity while not as critical as surface considerations can still affect plant growth and nutrient availability.

Table V-11. Deductions for subsurface acidity.

pH*	Percent deduction
5 and above	0
4.5	5
4.0	10
3.5	20

* Measured in saturated paste. Add 1/2 unit to pH values measured in CaCl2.

4. Subsurface salinity: Subclass N

Table V-12. Deductions for subsurface salinity

Salinity (dS/m)*	Percent deduction
4	0
8	10
16	20

* Saturation extract or equivalent.

C. Drainage: Subclass W

Organic soils are generally characterized by excess water in their natural state. However, uncontrolled drainage can lead to drought, high rates of subsidence, potential physical damage to the soil and increased erosion (or fire) hazard. Drainage is therefore rated according to the depth of an uncontrolled or controlled water table (Table V-6). It should be noted the organic soils, because of their very porous nature, can be droughty if the water table is too low, hence the increasing limitation below a depth of 90 cm.

Drainage characteristics are considered as a modifier of the organic soil rating and are therefore used as a percent deduction of the final organic soil rating.

Table V-13. Deductions for organic soil drainage.

Depth to water table (cm)		Percent deduction
Uncontrolled	- at surface	100
	- below surface	70
Controlled	- 20 cm	50
	- 50 cm	0
	- 90 cm	0
	- 120	30

D. Calculation of the organic soil rating (O)

The attached worksheet (Fig. V-1) should be used to facilitate the calculation. The following steps are suggested.

1. From the climate calculation assign the soil climate value. If the climate calculation has not been done then locate the site on the energy climate map and determine the value.

2. Assign the appropriate deduction (in Alberta use 15).

3. Examine the soil (or supplied information) and fill in the "value" for each parameter. For example, degree of decomposition = mesic, wood fragments = none, pH = 4.5, etc.

4. Using the tables or charts in this section assign the appropriate penalty points. In this example they would be 0, 0 and 20 respectively.

5. Total the points for the surface section and substract from 100 to give the basic rating (a).

6. Determing the values for the subsoil factors.

7. Assign the appropriate percent deductions.

8. Total the deductions and multiply times the basic rating to give the subsoil deductions (b).

9. Basic rating - subsoil deduction = interim rating (c).

10. Determine the drainage "value".

11. Assign the appropriate percent deduction.

12. Multiply the % deduction by the interim rating (c) to get the drainage deduction (c).

13. The basic rating -(subsoil and drainage deductions) = the final organic soil rating.

14. You may wish to place the soil into a capability class using the classification table (II-1). You should at this stage also identify any factors which resulted in a greater than 15 point or percentage deduction and assign the appropriate subclass symbol.
    For example, a final rating of 35 with 20 points deducted for nutrient status and 40 points deducted for drainage would be 4 WG.

Organic Soil (O)

factors	value	point deduction
1. Surface factors (point deductions)		
- energy (EGDD)	________	15
- degree of decomposition (B)	________	________
- wood fragments (I)	________	________
- nutrient status (G) pH =	________	________
- salinity (N)	________	________

Basic Organic Rating = 100 - ________ = a)________

2. Subsoil factors (percent deductions)		percent deduction
- depth of deposit (X)	________	
- underlying material	________	________
- presence of Ah horizon	Y N	________
- degree of decomposition (B)	________	________
- wood content (I)	________	________
- acidity (V)	________	________
- salinity (N)	________	________

Subsoil deduction = _______% x a)= b)_______

Interim Soil Rating = a)______ - b)______ = c)______

3. Drainage factor (percent deduction)		
- drainage (W)	________	________

Drainage deduction = _______% x c)= d)_______

FINAL ORGANIC SOIL RATING (O) = a)______ -[b)______ + d)______] = ________

= Class ______ , ____ ____ subclass

Fig. V-3. Worksheet for organic soil rating.

NOTES

Chapter VI The Landscape Factors.

The features associated with the landscape evaluation are mainly related to management rather than productivity. However, because these features can, by themselves, limit commercial agriculture they are rated separately from climate and soil parameters. Three factors have been identified - topography, stoniness and landscape pattern (or obstacles to farming). Topography is considered as the basic rating with the other two as modifiers.

A. Slope steepness and length

As slope increases above 10% there are increasing machinery limitations but the main concern is the sustainability of the productive capacity of the land. Slope steepness, unless it is large enough to affect the amount of sunshine received, does not have a large impact on yield. However, if one is going to maintain a productive land base, it is necessary to manage steep slopes differently from level areas so that erosion does not limit soil depth which can in turn reduce yields. Length and steepness of slope (LS factor) are the controlling landscape parameters and have been combined (Table VI-1) into a single factor.

Table VI-1. Relative values of LS for combinations of slope length and steepness.*

	Slope length (m)					
% slope	30	50	100	150	200	300
1	0.1	0.1	0.2	0.2	0.2	0.2
2	0.2	0.2	0.3	0.3	0.4	0.4
3	0.3	0.4	0.4	0.5	0.6	0.7
4	0.4	0.5	0.7	0.8	0.9	1.1
5	0.5	0.7	1.0	1.1	1.3	1.6
6	0.7	0.9	1.2	1.5	1.8	2.2
7	0.8	1.1	1.5	1.9	2.2	2.7
8	1.0	1.3	1.9	2.4	2.9	3.4
9	1.2	1.6	2.3	2.9	3.6	4.2
10	1.4	1.9	2.8	3.5	4.2	4.9
11	1.6	2.1	3.2	4.1	4.8	5.6
12	1.8	2.5	3.7	4.7	5.6	6.3
13	2.0	2.9	4.1	5.3	6.3	7.1
14	2.3	3.3	4.6	5.9	7.1	7.8
15	2.6	3.7	5.1	6.5	7.8	8.6
20	4.1	5.3	7.4	9.0	11	13

* Modified from the Universal Soil Loss Equation (Wischmeier and Smith 1965).

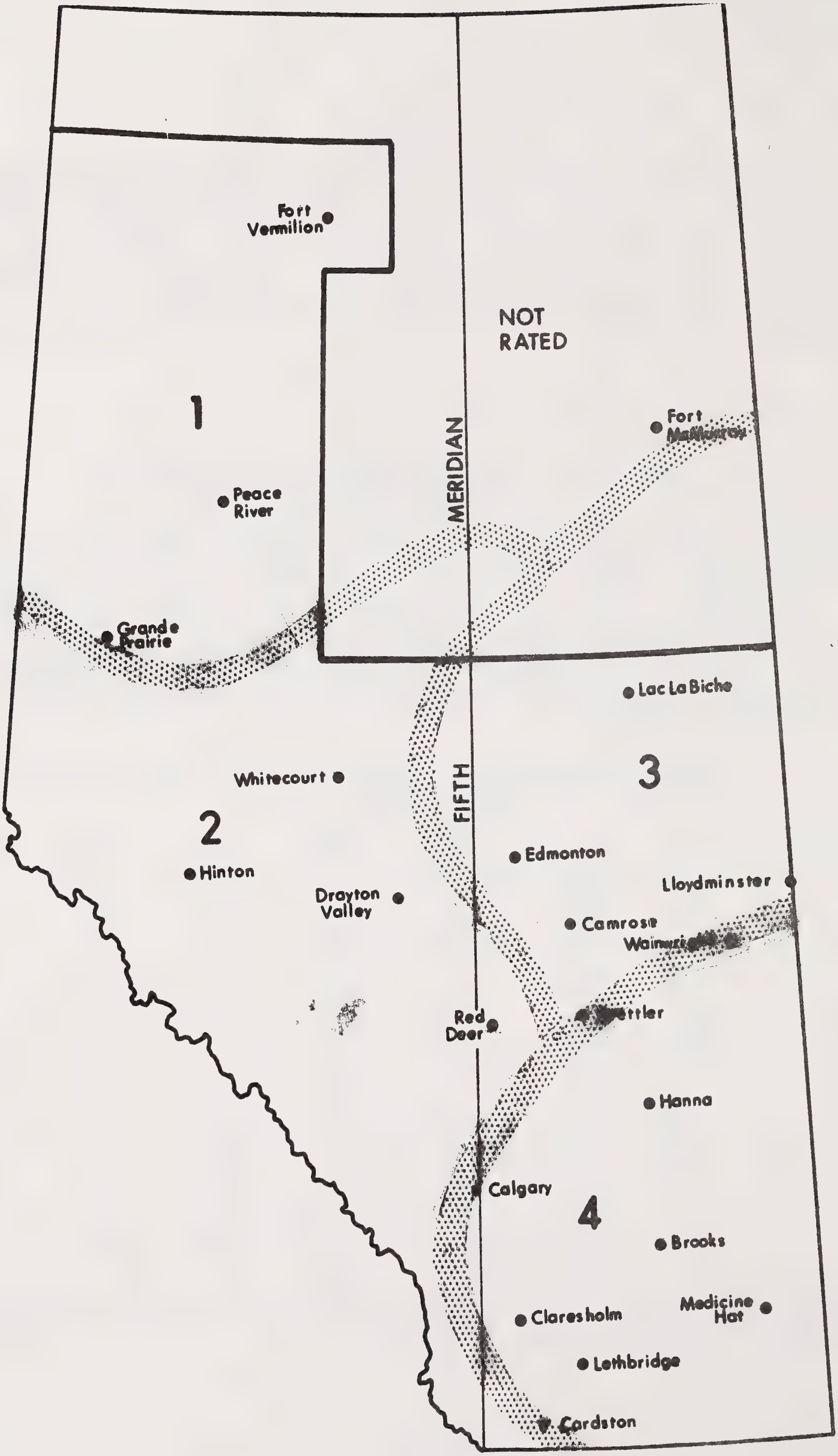


Fig. VI-1. Regions of similar water erosion potential considering precipitation, soils and crops. (modified from Tajek and Pettapiece 1986)

Erosion potential depends not only on length and steepness of slope, but also on such factors as time, amount and intensity of precipitation, cropping practices and kind and condition of soil. Initially it is suggested that a broad regional map (Fig. VI-1) be used to combine these factors. Four areas are recognized:

1. The Peace River area: which has a high proportion of highly erodible soils and high rates of spring runoff.
2. The uplands and foothills of the west: which have the highest precipitation factor.
3. The central region: which has moderate precipitation and soils of medium erodibility.
4. The south: which has the lowest erosion potential considering both precipitation and soils.

Table VI-2. Deductions for various LS/region combinations.

LS**	Deduction		
	Regions 1 & 2	Region 3	Region 4
0.1	10	0	0
0.3	20	10	0
0.5	30	20	10
1.0	40	30	20
1.5	40	40	30
2.0	50	50	40
3.0	60	60	50
5.0	70	70	60
10.0	80	80	70
25% slope	85	85	80
30% slope *	90	90	85

* Deduct an additional 1 point for each 10% exposed bedrock or bare soil on steep non-cultivated slopes.

** From Table VI-1.

B. Modifying Factors

1. Stoniness factor: Subclass P

The presence of stones or cobbles can become a significant factor in farm management. If severe enough they can limit the capability to a non-arable class and are therefore rated on a 0 - 100 scale. Three size classes of coarse fragments are recognized:

a) Gravel - diameter less than 8 cm (3 in.),
b) Cobbles - diameter 8-25 cm (3-10 in.), and
c) Stones - diameter >25 cm (>10 in.)

Only cobbles and stones are included in this rating as a landscape problem (Table VI-3).

Table VI-3. Point deductions for surface stoniness.

Stoniness class	Comments		Deduction	
	% cover	approx. distance apart(m)	cobbles	stones
1	<0.1	20	0	5
2	0.1-3	10	10	30
3	3-15	2	50	70
4	15-50	0.2	70	80
5	over 50	<0.2	90	100

In forested situations where surface stoniness is difficult to assess, the following guidelines based on content of stones and cobbles in the profile may be used.

Table VI-4. Relationship of stoniness class to cobble and stone content.

Cobbles and stones % by volume	Approximate equivalent stoniness class
>2%	1
2-5%	2
6-15%	3
16-30%	4
>30%	5

2. Landscape pattern (obstacles): Subclass J.

Modern mechanized agriculture is geared to large homogeneous fields. Obstacles (such as sloughs, wellsites, powerpoles, etc.) result in an overlap of field operations and increased input per unit area. This rating applies only to the increased management requirements resulting from obstacles and is not considered as important as the steepness or stoniness factors. It is suggested that the rating of this factor should only be used if, in the assessor's opinion, the obstacles are severe enough to affect the capability. The suggested rating in these cases is a one percent deduction for every slough (or other obstacle) per one quarter section up to a maximum of 20 percent.

C. Calculation of the Landscape Rating (L)

The attached worksheet (Fig. VI-2) should be used to facilitate the calculation. The following steps are suggested:

1. Estimate and record the average slope steepness and length.
2. Determine the LS value using Table VI-1.
3. Determine the region using Fig. VI-1.
4. Assign the appropriate slope deduction from Table VI-2.
5. Subtract the deduction from 100 to give the basic landscape rating (a).
6. Assign and record the stoniness class (and size).
7. Assign the appropriate stoniness deduction (Table VI-3).
8. Multiply the stoniness % deduction times the basic rating to give the stoniness deduction (d).
9. Determine the number of significant obstacles per 1/4 section.
10. At 1% per obstacle, determine the obstacle deduction by multiplying by the interim landscape factor (c).
11. The basic rating - (stoniness and pattern deductions) gives the final landscape rating.
12. You may wish to place the landscape factor into a capability class using the classification table (II-1).

You should at this stage also identify any factors which resulted in a greater than 15 point or percentage deduction and assign the appropriate subclass symbol. For example, a final rating of 75 with 20 points deducted for slope (topography) would be 2T.

Landscape (L)

factor	value	point deduction
1. Slope (T)		
- slope steepness	________%	
- slope length	________m	
- LS factor	________	
- region	________	________ --------

Basic landscape rating = 100 - ________ = a)________

		percent deduction
2. Stoniness (P) (percent deduction)		
- class	________	
- average size	________cm	________ --------

Stoniness deduction = ________% x a) = b)________

Interim landscape rating = a)________ -b)________ = c)________

3. Pattern (J) (percent deduction)		
- no of obstacles per 1/4 section	________	________ --------

Pattern deduction = ________% x c) = d)________

FINAL LANDSCAPE RATING (L) = a)______- [b)______ + d)______]= ______

= Class ________,______ ______
subclasses

Fig. VI-2. Worksheet for landscape rating.

NOTES

Chapter VII How to use the system.

The previous chapters described the system concept, the rating of individual factors and the calculation of classes for the climate, soil and landscape components. This chapter will illustrate the general field application of the system. It will include: a) the Agricultural Capability Rating Form,
b) an example calculation, and
c) a discussion of some common field problems.

A. The Agricultural Capability Rating Form.

The rating form (next page) is intended to be used as an integral part of the rating process. It allows for documentation of pertinent data relating to the climate, soil and landscape components. It also provides a guide for the final rating calculation. A loose copy (for duplication) may be found in the pocket at the back of the report.

A companion form, the Factor Evaluation Sheet, is designed as a quick reference for rating the individual factors. A loose copy of this sheet may also be found in the pocket. It is suggested that the form be plasticized for field use. If more detail is required in the climate and landscape figures one should refer back to the report.

B. Sample Calculation.

Following is a sample situation from the Brown Zone of southern Alberta. An additional six examples representing the range of conditions commonly found in the province may be found in Appendix C. There are several parts of the calculation which require special note:

a) Only the most limiting of pH, salinity and sodicity are used in the final deductions.These factors are closely correlated and use of all three would result in double penalties.

b) For the same reason, subsoil salinity and sodicity are only deducted if they are more limiting than at the surface.

c) Only one of the climatic A factor and the soil M factor should be indicated on the final rating even in the event that both are important. The general rule is that if an evaluation of the texture results in a greater than 15 point deduction then M should be used.

AGRICULTURAL CAPABILITY RATING FORM (1987)

MAP AREA: ____________________ NAME: ______________ Date: ______________

SOILS (S)

Map Component 1. ____________ ____ 2. ____________ ____
Name % Name %

factor	value	deduction	value	deduction
1. Surface factors				
texture (M)				
subsoil adjust.				
structure (D)				
org. matter (F)				
depth (E)				
acidity (V)				
salinity (N)				
sodicity (Y)				
calcareous (K)				
organic (O)				

Basic Soil Rating = 100 - ____ = (a) ____ 100 - ____ = a) ____

2. Subsoil factors (% deduction)				
structure (D)				
depth (R,D,M)				
acidity (V)				
salinity (N)				
sodicity (Y)				

Subsoil deduction = ____% of a=b) ____ = ____% of a = b) ____

Interim Soil Rating = a - b = c) ____ a - b = c) ____

3. Drainage factor (% deduction)				
drainage (W)				

Drainage deduction = ____% of c=d) ____ ____% of c = d) ____

Final Soil Rating(S) = a - (b + d) = ☐ S = a - (b + d) = ☐

LANDSCAPE (L)

Map Component 1. ____________ ____ 2. ____________ ____
Name % Name %

factor	value	deduction	value	deduction
1. Slope (T)				
steepness	____%		____%	
length	____m		____m	
LS factor				
region				

Basic landscape rating = 100 - ____ = a) ____ 100 - ____ = a) ____

2. Stoniness (P) (% deduction)				
class				
average size				

stoniness deduction = ____% of a)=b) ____ ____% of a)=b) ____

Interim landscape rating = a - b = c) ____ a - b = c) ____

3. Pattern (J) (% deduction)				
number of obstacles per ¼ section				

Pattern deduction = ____% of c)=d) ____ ____% of c)=d) ____

Final Landscape Rating(L) = a - (b + d) = ☐ L = a - (b + d) = ☐

MAP AREA: ____________ NAME: ____________ Date: ____________

AGROCLIMATE (C)

factor	value	deduction	
1. Moisture Component (A)			
P-PE Index	____	____	
A = 100	-	____	= ____
2. Energy Component (H)			
E G D D Index	____	____	
H = 100	-	____	= ____

factor	value	deduction
3. Modifying factors (% deduction)		
spring moisture	____	____
fall moisture	____	____
local frost	____	____
hail	____	____
		b) ____ %

Basic Climate rating is lowest of A or H = (a) ____

Modification deduction = b% of a=c) ____

Final Climate Rating = a - c = ☐

ORGANIC SOILS (O)

factor	value	deduction
1. Surface factors		
energy (EGDD)(Z)		15
decomposition(B)	____	____
wood (I)	____	____
nutrient st.(G)pH=	____	____
salinity (N)	____	____

Basic Organic Rating = 100 - ____ = a) ____

2. Subsoil factors (% of deduction)		
depth of deposit(X)	____	
underlying material	____	____
presence of Ah(Y N)	____	____
decomposition (B)	____	____
wood (I)	____	____
acidity (V)	____	____
salinity (N)	____	____

Subsoil deduction = ____ % of a)=b) ____

Interim soil rating = a - b = c) ____

factor	value	deduction
3. Drainage factor (% deduction)		
drainage (W)	____	____

Drainage deduction = ____ % of c)=d ____

Final Organic Rating (O) = a-(b+d) = ☐

FINAL RATING CALCULATION

	index			factors		%
C =	____	or class	____,	____	____	( )
S =	____	or class	____,	____	____	( )
S =	____	or class	____,	____	____	( )
O =	____	or class	____,	____	____	( )
L =	____	or class	____,	____	____	( )
L =	____	or class	____,	____	____	( )

Index	Class
80 - 100	1
60 - 79	2
45 - 59	3
30 - 44	4
20 - 29	5
10 - 19	6
0 - 9	7

Most limiting component = ____ at an index of ____ or class ____

Other significant components are ____ at an index of ____ or class ____

and ____ at an index of ____ or class ____

Symbol

C S(O) L %

Class ____ ____ ____ ____ ____ ____ ( )

classes factors

Comments

C S(O) L

Class ____ ____ ____ ____ ____ ____ ( )

classes factors

1. LOCATION: NE 10-14-11 W4

2. LANDSCAPE: hummocky till

Slope characteristics: 8% slopes, 50 m long

Pattern: 4 depressions in quarter

Surface stoniness: fairly stony on knolls (S1-2) mainly small

3. SOILS: Brown Chernozemic
(Maleb series dominant)

Profile description:

horizon	depth ~~cm~~	texture * ~~fibre~~ ~~wood~~	structure	consistence	color
Ah	0-8	L	granular	friable	10YR 5/3 brown
Bm	8-23	CL	prismatic	firm	4/4 dk. yellowish brown
Cca	23-76	L	pris.-mass	friable	5/3
Csk	76-100+	L-CL	massive	friable-firm	3.5/4

*for organic soils use % rubbed fibre and % wood.

Laboratory analysis:

horizon	pH	E.C.	Sat%	SAR	CaCO3	>2mm	S	Si	C
Ah	7.3	<1		–	0.5	5	41	35	24
Bm	7.0	<1		–	–	2	37	33	30
Cca	7.8	1		–	8	5	36	37	27
Csk	8.1	5		16	5	5	39	32	29

Drainage: well drained

4. COMMENTS: depth of Ah ranges from 5 cm on knolls to about 18 cm on lower slopes

AGRICULTURAL CAPABILITY RATING FORM (1987)

MAP AREA: NE 10-14-11 W4 NAME: WP Date: May/87

SOILS (S)

Map Component 1. ______ Name ______ % 2. ______ Name ______ %

factor	value	deduction	value	deduction
1. Surface factors				
texture (M)	L	58		
subsoil adjust.	CL	–		
structure (D)	gran	0		
org. matter (F)	brown	5		
depth (E)	8cm	2		
acidity (V)	7.3	0		
salinity (N)	–			
sodicity (Y)	–			
calcareous (K)	0.5	0		
organic (O)	–			

Basic Soil Rating = 100 - 65 = (a) 35 100 - ___ = a) ___

factor	value	deduction	value	deduction
2. Subsoil factors (% deduction)				
structure (D)	prism	0		
depth (R,D,M)	–			
acidity (V)	–			
salinity (N)	≃ 2	0		
sodicity (Y)	–			

Subsoil deduction = 0 % of a=b) 0 = ___ % of a = b) ___

Interim Soil Rating = a - b = c) 35 a - b = c) ___

factor	value	deduction	value	deduction
3. Drainage factor (% deduction)				
drainage (W)	well	0		

Drainage deduction = 0 % of c=d) 0 ___ % of c = d) ___

Final Soil Rating(S) = a - (b + d) = $\boxed{35}$ S = a - (b + d) = $\boxed{}$

LANDSCAPE (L)

Map Component 1. ______ Name ______ % 2. ______ Name ______ %

factor	value	deduction	value	deduction
1. Slope (T)				
steepness	8 %		%	
length	50 m		m	
LS factor	1.2			
region	4	14		

Basic landscape rating = 100 - 14 = a) 86 100 - ___ = a) ___

factor	value	deduction	value	deduction
2. Stoniness (P) (% deduction)				
class	1-2			
average size	<10	5		

stoniness deduction = 5 % of a)=b) 4 ___ % of a)=b) ___

Interim landscape rating = a - b = c) 82 a - b = c) ___

factor	value	deduction	value	deduction
3. Pattern (J) (% deduction)				
number of obstacles per ¼ section	4	4		

Pattern deduction = 4 % of c)=d) 3 ___ % of c)=d) ___

Final Landscape Rating(L) = a - (b + d) = $\boxed{79}$ L = a - (b + d) = $\boxed{}$

MAP AREA: NE10 - 14 - 11W4 NAME: WP Date: May/87

AGROCLIMATE (C)

factor	value	deduction	
1. Moisture Component (A)			
P-PE Index	-480	48	
A = 100	-	48	= 52
2. Energy Component (H)			
E G D D Index	1575	0	
H = 100	-	0	= 0

factor	value	deduction
3. Modifying factors (% deduction)		
spring moisture	-70	0
fall moisture	-45	0
local frost		
hail	5	0
		b) 0 %

Basic Climate rating is lowest of [✓ A] or H = (a) 52

Modification deduction = b% of a=c) 0

Final Climate Rating = a - c = 52

ORGANIC SOILS (O)

factor	value	deduction
1. Surface factors		
energy (EGDD)(Z)		15
decomposition(B)		
wood (I)		
nutrient st.(G)pH=		
salinity (N)		

Basic Organic Rating = 100 - ______ = a)______

factor	value	deduction
2. Subsoil factors (% of deduction)		
depth of deposit(X)		
underlying material		
presence of Ah(Y N)		
decomposition (B)		
wood (I)		
acidity (V)		
salinity (N)		

Subsoil deduction = ______% of a)=b)______

Interim soil rating = a - b = c)______

factor	value	deduction
3. Drainage factor (% deduction)		
drainage (W)		

Drainage deduction = ______% of c)=d______

Final Organic Rating (O) = a-(b+d) = ☐

FINAL RATING CALCULATION

	index			factors		%
C =	52	or class	3,	A		( )
S =	36	or class	4,	A		( )
S =		or class	,			( )
O =		or class	,			( )
L =	79	or class	2,	T		( )
L =		or class	,			( )

Index	Class
80 - 100	1
60 - 79	2
45 - 59	3
30 - 44	4
20 - 29	5
10 - 19	6
0 - 9	7

Most limiting component = S at an index of 36 or class 4

Other significant components are C at an index of 52 or class 3

and T at an index of 79 or class 2

Symbol

4 / Class — C S(O) L: 3 4 2 (classes) — A T ______ (factors) % ( )

Comments

4AT

Class — C S(O) L: ______ ______ ______ (classes) — ______ ______ ______ (factors) ( )

C. Common Field Problems.

1. Measuring or rating individual factors.

Some features are relatively stable and can be measured accurately. Others can change over short distances or even from one season to another. There was reference to this point in the section on data requirements where it was indicated that climatic parameters represent long term averages with significant year-to-year variation. Soil and landscape features are more permanent but still exhibit some variation.

Texture will often vary with depth. The usual procedure is to arrive at an average. In the subsoil the whole depth (20 - 100 cm) should be considered unless there is a discontinuity in materials, in which case refer to the section on nonconforming layers (IV - B - 3).

Structure and particularly consistence can change with moisture content. Moisture extremes should be avoided if possible with "moist" being the ideal. If there is a discrepancy between ratings of structure and consistence, use the most limiting.

Acidity can vary by up to one pH unit over the growing season so estimates to the nearest 1/2 unit are adequate. Also more than one landscape position should be checked and an average or the least limiting value used.

Salinity is even more variable than pH with surface values commonly higher in the spring or after a prolonged dry spell. Vegetation growth, which tends to average annual variation, is often a better indicator than individual EC values.

Organic surface horizons can mineralize at a rate of 1 to 3 cm per year. Therefore depths of less than 10 cm are not considered in the rating which should then be based on characteristics of the mineral soil. The same is true for LFH or duff layers even though the incorporation of these layers can be beneficial.

Drainage, in this assessment, is related specifically to the growing season. Water tables near the surface are obviously a management problem and can be rated as a limitation. However in our generally moisture-stressed growing season water tables at depth can be a benefit, a factor which is not addressed. This "sub-irrigation" is particularly beneficial in the case of sandy soils, and a bonus rating might be considered. Such a bonus would be deducted from the M factor.

Landforms are seldom uniform and a hummocky situation can have slopes ranging from 0 to 10 or 15%. Common practice is to express the slope in terms of the generally limiting slope. This will be higher than the average but lower than the extreme slope. For example, an area designated as a 7% slope will usually have 50% of the area with slopes less than 3% and a few slopes as high as 10%. The slope length then becomes the average length associated with the limiting slope.

2. Landscape variability

Some variation is to be expected in all factors over a parcel of land. This feature of natural landscapes is a continual concern to the evaluator who must be prepared to make field decisions concerning landscape uniformity. Aerial photographs are a valuable aid but there is no substitute for site inspections. Experience also helps a great deal, mainly in choosing appropriate sites for inspection or in evaluating the relevance of a site to the rest of the parcel. At very detailed levels of investigation (eg. 1:5,000) the individual units will usually have less variability than the broader map units or parcels associated with small scale work (eg. 1:100,000).

There are two principal ways of approaching this problem:

a) Average all the characteristics.
b) Recognize and describe the different components.

The first method works well where the variation is not too great. For example, surface textures ranging from sandy loam to loam to silt loam could be averaged to loam. It requires some judgement and evaluation to assess where the emphasis should be placed but is manageable. Averaging works less well where the features are strongly contrasting. For example, if 50% of an area is well drained (eg. sand dunes) and 50% is very poorly drained (bog), it would not be correct to say that the whole area is imperfectly drained. In this case use of the second method, recognizing two soil components, rating each one separately and presenting as a complex rating, would be more realistic.

Two questions are pertinent to this discussion.

a) Are the components contrasting?
b) Can the components be managed separately?

Contrasting may be defined as differing by more than one capability class (degree of limitation). That is class 2 vs class 4 or class 6. If this is the case then complexing would be appropriate. But contrasting also includes those components with different kinds of limitations. For example, class 5 due to wetness (5W) and class 5 due to soil structure (5D) are contrasting because of the very different management practices associated with each component. Again complexing should be considered.

However, if the contrasting soils are so intimately associated that they can not be managed separately then they should carry a single rating. It is then a question of deciding whether to average the components or to assess on the basis of the most limiting factor. Fig. VII-1 illustrates the kind of situation which can arise. In this example, a floodplain is so cut-up that it is practically inaccessible. To average it to class 4 is perhaps better than saying 60% class 2, but still does not recognize the limitation properly. In this case class 6 might be the most appropriate.

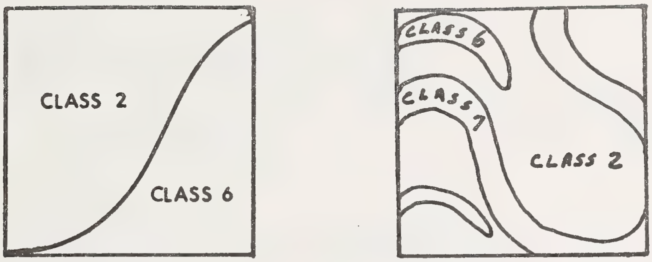


Fig.VII-1. Two types of complex areas.

A practical approach is to first determine if there is a contrasting component. If so, rate it first. If there is another contrasting component then rate it. Average the remainder into the third component. It is often necessary to recognize two components in a unit but it is suggested that 3 components should be used rarely and should be the maximum. The sample documentation forms allow for 2 components. If three are to be recognized an additional sheet is required.

NOTES

Chapter VIII Applications of the System.

The intent of this chapter is to indicate how the agricultural rating system presented herein compares to previously used systems in Alberta, how it can be used in the land use planning process, how it can be modified for specific applications and some limitations of the sytem.

A. Comparison with Previous Sytems.

Table VIII-1. A comparison of agricultural rating systems in Alberta

Component	Storie index	CLI	New system
general	-productivity -8 factors -factors indexed -8 classes -limitation (not specified)	-capability -11 factors -factors not indexed -7 classes -limitation (specified)	-capability -17 factors -factors indexed -7 classes -limitation (specified)
climate	-soil zone frost modifier -soil zone map	-frost free period -annual precipitation -Bowser map (1967)	-growing season -moisture index (P-PE) -energy index (EGDD and modifiers)
soils	-soil taxonomy -profile variation -texture -drainage -organic rating -wide range in ratings	-structure -salinity -texture -drainage -erosion -no organic rating -subjective	-separates surface soil -texture -structure -salinity, pH -organic mat. -depth -sodicity -drainage -organic rating -more quantitative
landscape	-stoniness -topography	-stoniness -topography -inundation	-stoniness -slope length and steepness -pattern

The Agricultural Ratings Working Group, in a preliminary study, compared the Storie index approach used by Municipal Affairs and Energy and Natural Resources and the CLI: Soil Capability for Agriculture used by the Soil Survey (Alberta Soils Advisory Committee 1983). The Storie system had been modified by user agencies but in both cases was utilized to rate land at a quarter section or site level for agricultural production. The CLI system assesses agricultural capability from a regional perspective. A criticism of both approaches was the lack of specificity and difficulty in maintaining consistency among users of the systems. The new system has drawn extensively from the previous systems. It has not introduced new factors but has separated and reorganized components and supports a more quantitative approach. Table VIII-1 provides a brief comparison.

B. Relationship of Agricultural Rating to Land Use Planning.

It was stated earlier that land use planning is an important use of an agricultural rating system. There are several concepts involved in that link. First is the definition of land use planning: to guide the decisions on land use in such a way that the resources of the environment are put to the most beneficial use for man, whilst at the same time conserving those resources for the future (FAO 1976). The planning in turn requires land evaluation: a comparison of the benefit obtained (or potentially attainable) and the inputs required on different types of land. Different uses should also be considered. Land evaluation may be considered in terms of physical land evaluation, an assessment of the natural resource, or integral land evaluation which includes social and economic aspects (Smit et al 1984). They are complementry considerations both of which are basic to the overall planning process.

An agricultural rating is part of the physical land evaluation. In areas where agriculture is the main endeavour it may be the only physical component involved. In areas of competing use of the natural resource base it would be only one of several which might include forestry, wildlife or industrial assessments. The point is that agricultural rating is only part of the planning process. In some instance it has been used exclusively in land use plans to a) allow for alienation of public lands if over a specified rating or b) allow subdivision if below a particular value. This might or might not be an appropriate use but it must be stressed that it is not the rating system which governs the land use but rather the decision of the planning body to use the rating system and to define specific critical values.

The proposed system outlined in this report includes the identification and assessment of specific limitations. This allows the planning function to consider not only the relative present value for agriculture but also to consider the kind and cost of management options to overcome those limitations. A climate limitation, for example, might preclude further agricultural consideration but a soil limitation might have a practical, economic solution which should be viewed in terms of other benefit-cost evaluations.

C. Application to Disturbed/Reclaimed Lands.

The system can be used to assess the agricultural capability of the post- as well as the pre-disturbed condition. The component factors are all measurable climate, soil or landscape features that affect plant growth and which are not dependent on undisturbed sites or traditional taxonomic classifications. The fact that the pre- and post- condition may be quite different in terms of the soil and landscape characteristics should in no way reduce the reliability of the agricultural capability assessment. The kinds and degrees of limitation may be different but the comparative assessment should be valid. Also, if the reclaimed condition had a lower capability than prior to disturbance, the specific limitations would be clearly identified and remedial measures could be designed.

D. Modifications for Specific Purposes.

The majority of factors in the rating relate to plant growth, so it follows that the system might be applied to any plant related assessment. This is only partially true. The present system uses ratings which reflect limitations to a particular range of crops - the common small grains and oilseeds. The same factors would be relevant to other plants but the specific rating scales might change.

A suitability rating for sugar beets, for example, would have to recognize different class limits for the climatic parameters and, if under irrigation, textural limitations would also change. For onions, the salinity ratings would need to be changed and root crops might be more sensitive to the structure and consistence factor. Again, with a change in ratings the system could potentially be applied to rangelands although a vegetation component would need to be added.

Forestry is another area to which the system might be applied. Under a sustained yield policy there will be a move to more forest management which will require an assessment of potentials and limitations for efficient targetting and planning. Clearly the landscape factors of slope and stoniness would not need to be as restrictive as for annual cultivation. Also the climate factors would need to be altered in terms of class limits and possibly in the indices as well. The same kind of attention would need to be given to each of the soil factors which might or might not be rated differently, depending on the requirement or restriction for forest growth. While the individual ratings might change, the factors would still be applicable and the same approach could be used for assessing the capability of tree crops as for cultivated agricultural crops.

E. Some Limitations of the System.

The Agricultural Rating System outlined here is flexible in that it can accommodate a good deal of variability in data detail. However, there are a number of limitations, related mainly to the assumptions listed in Chapter II.

1. The system is designed to assess arable agriculture and cannot be used (without modification) for any other purpose such as carrying capacity for livestock.
2. The system is designed to assess capability for sustained agricultural production. It is not an assessment of crop productivity, which also relies on species selection, management inputs and annual climatic variation.
3. The system does not address unusual nutrient deficiencies (or excesses) in mineral soils.
4. The system does not indicate "best" use or "most profitable" use; these include social and economic considerations.
5. The system does not correspond exactly to previous systems therefore ratings may differ somewhat at both site specific and regional levels. This may affect planning decisions based on past ratings.

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Appendix A. Supplementary Data in Support of the Rating System.

1. A comparison of texture and available water holding capacity.

The plant available water held by a soil varies with texture (which includes coarse fragment content), organic matter content, bulk density and water table depth. In general higher silt plus clay contents will hold more water but at very high clay contents less of it may be available for plant growth (Table A-1). Available moisture also rises slightly with organic matter content. These factors are not usually uniform in natural soil landscapes with texture often finer in the subsoil but organic matter decreasing with depth. Typical values for an Orthic Dark Brown Chernozemic soil are shown in Table A-1.

Table A-1. Estimated available water holding capacity as related to texture and organic matter content.*

	Texture					
Water/category	S-LS	SL	L	SiL-CL	SICL-C	HC
cm water/cm soil (0% O.M.)	0.05	0.07	0.09	0.12	0.15	0.13
cm water/cm soil (2% O.M.)	0.06	0.08	0.10	0.13	0.16	0.14
cm water/cm soil (5% O.M.)	0.07	0.09	0.11	0.14	0.17	0.15
cm water/120 cm (Orthic Dark Brown)	8	11	14	17	23	20

* Based on regression equations of deJong and Loebel (1982).

Soil material larger than 2 mm in diameter does not hold water and the volume occupied by coarse material reduces the available water capacity by an equivalent amount. That is, a soil with 25% coarse fragments would have only 75% as much available water as the same soil without gravel or stones. As mentioned previously (Chapter IV) most agricultural soils have less than 5% coarse material and this factor is generally ignored. However, if it is important, the texture rating can be modified as follows. Reduce the appropriate water holding capacity (texture) by an amount equal to the % coarse material. Locate the reduced value in Table A-1 and use the "equivalent" texture in the rating using Table IV-1.

Table IV-1 shows the combined soil-climate effect on moisture limitation. The following table illustrates the soil contribution.

Table A-2. Rating for the soil texture contribution to moisture stress.

Climate index	Base rate	Texture								
		S	LS	SL	L	SiL	CL	SiCL	SiC	C
-100	0	45	25	0	0	0	0	0	0	0
-180	10	45	30	10	0	0	0	0	0	0
-260	20	45	30	15	5	0	0	0	0	0
-340	30	45	30	20	10	0	0	0	0	0
-420	40	45	30	20	10	5	0	0	0	0
-500	50	40	30	20	10	5	0	0	0	0
-540	55	35	25	20	10	5	5	0	0	0

2. Comparison of structure, consistence and bulk density.

The influence of bulk density on root growth has been well documented. The general relationships between bulk density, texture and root growth suggest that a bulk density of 1.8 g/cc will essentially restrict root growth. Also, clay soils are more restrictive than sands at similar densities. This is related in large part to the small size of the pores and resulting poor aeration in clays. These considerations are reflected in the data presented in Table A-3.

Table A-3. Relative deductions for bulk density/texture combinations.

% C		5	15	30	45	60
%Si & C		20	40	60	80	90
Bulk density \ Texture	S & LS	SL	L	SiL & CL	SiC-C	HC
1.20	0	0	0	0	0	0
1.30	0	0	0	0	0	5
1.35	0	0	0	0	5	10
1.40	0	0	0	5	10	20
1.45	0	0	5	10	20	40
1.50	0	5	10	20	40	50
1.60	10	20	30	40	55	70
1.70	30	40	50	60	70	90
1.80	50	60	70	80	90	-

Bulk density is not easily measured in the field but there are some general relationships to structure and consistence which can be used for estimating resistance to root growth (Table A-4). The reader should be aware that these are common or usual relationships but are not absolute.

Table A-4. Common relationships between kind of horizon, structure, consistence, texture and bulk density.

Kind of horizon	Common structure	Common consistence dry/moist	S LS	SL	L	SiL CL	SiCL SiC	C
Ah	granular	sl hard friable	1.30	1.20	1.15	1.10	1.00	0.95
Ae	platy, massive	soft,sl.hard friable	1.45	1.40	1.35	1.30	1.30	-
Ap (>1% OM)	granular	friable	1.40	1.35	1.25	1.20	1.10	1.05
Ap (<1% OM)	massive	soft-hard friable-firm	1.40	1.40	1.40	1.35	1.30	1.25
Bm	subangular prismatic	sl hard friable-firm	1.50	1.45	1.40	1.40	1.35	1.30
Btj	blocky prismatic	hard firm	1.50	1.50	1.45	1.45	1.45	1.40
Bt	blocky	hard-v.hard firm-v.firm	-	1.55	1.55	1.60	1.60	1.50
Btnj	blocky-columnar	v.hard v.firm	-	1.50	1.50	1.50	1.50	1.45
Bnt	columnar-blocky	ex.hard ex.firm	-	1.60	1.60	1.65	1.60	1.50
Bn	columnar-massive	ex.hard ex.firm	-	-	1.65	1.65	1.60	1.50
Bf	wk.granular massive	sl.firm friable	1.50	1.45	1.35	1.35	-	-

Appendix B. Glossary of Terms

A horizon - A mineral horizon formed at or near the surface in the zone of removal of materials in solution and suspension, or maximum accumulation of organic carbon, or both.

Ae - An horizon that has been eluviated of clay, iron, aluminum, or organic matter, or all of these.

Ah - An horizon in which organic matter has accumulated as a result of biological activity.

Ap - An horizon markedly disturbed by cultivation or pasture.

acid soil - A soil having a pH of less than 7.0.

aggregate - A group of soil particles cohering so as to behave mechanically as a unit.

alkaline soils - Any soil that has pH greater than 7.0.

arable - Tillage;agricultural production based on cultivation practices; land that is cultivated or capable of being cultivated. Arable is used as a comparison to agriculture based on grazing (non-cultivated) systems.

B horizon - A subsoil horizon characterized by one of:
a) an enrichment in clay, iron, aluminum, or humus (Bt or Bf).
b) a prismatic or columnar structure that exhibits pronounced coatings or stainings associated with significant amounts of exchangeable sodium (Bn or Bnt).
c) an alteration by hydrolysis, reduction, or oxidation to give a change in color or structure from the horizons above or below, or both (Bm).

bedrock - The solid rock underlying soils and the regolith or exposed at the surface.

bog - A peat-covered or peat-filled wetland, generally with a high water table. The water of a bog is generally acid and low in nutrients. Bogs usually support a black spruce forest but may also be treeless.They are usually covered with sphagnum and feathermosses and ericaceous shrubs.

Brunisolic - An order of soils whose horizons are developed sufficiently to exclude them from the Regosolic Order but lack the degrees or kinds of horizon development specified for soils in other orders. They always have Bm or Btj horizons.

bulk density, soil - The mass of dry soil per unit bulk volume.

C horizon - A mineral horizon comparitively unaffected by the pedogenic processes operative in the A and B horizons except for the process of gleying (Cg) or the accumulation of calcium carbonate (Cca) or other salts (Csa). A naturally calcareous C horizon is designated Ck.

calcareous soil - Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with cold 0.1N hydrochloric acid.

capability - focuses on the nature and degree of limitations imposed by the physical characteristics of a land unit for a certain use (Smit et al 1983).

capability class - (soil) - The class indicates the general suitability of the soils for agricultural use. It is a grouping of subclasses that have the same relative degree of limitation of hazard. The limitation or hazard becomes progressively greater from Class 1 to Class 7.

capability subclass - (soils) - This is a grouping of soils with similar kinds of limitations and hazards. It provides information on the kind of conservation problem or limitation. The class and subclass together provide the map user with information about the degree and kind of limitation for broad land use planning and for the assessment of conservation needs.

cation - An ion carrying a positive charge of electricity; the common soil cations are calcium, magnesium, sodium, potassium, and hydrogen.

cation exchange capacity (C.E.C.) - A measure of the total amount of exchangeable cations that can be held by the soil; it is expressed in terms of mols per kg of soil (formerly meq/100g).

Chernozemic - An order of soils that have developed under xerophytic or mesophytic grasses and forbs, or under grassland-forest transition vegetation, in cool to cold, subarid to subhumid climates. The soils have a dark-colored surface (Ah,Ahe or Ap) horizon and a B or C horizon, or both, of high base saturation. The order consists of the Brown, Dark Brown, Black and Dark Gray great groups.

chroma - The relative purity, strength, or saturation of a color; directly related to the dominance of the determining wavelength of the light and inversely related to grayness; one of the three variables of color.

classification, soil - The systematic arrangement of soils into categories and classes on the basis of their characteristics. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed differences in specific properties.

clay - as a particle-size term: a size fraction <0.002 mm equivalent diameter.

clod - A compact, coherent mass of soil produced by digging or plowing.

coarse fragments - Rock or mineral particles >2.0 mm in diameter.

coarse texture - The texture exhibited by sands, loamy sands, and sandy loams except very fine sandy loam. A soil containing large quantities of these textural classes.

consistency - (i) The resistance of a material to deformation or rupture. (ii) The degree of cohesion or adhesion of the soil mass. Terms used to describe a moist soil are - loose, very friable, friable, firm, very firm, compact, very compact, and extremely compact.Terms used to describe dry soils are - loose, soft, slightly hard, hard, very hard and extremely hard.

control section - The vertical section upon which soil classification is based.

drainage - Soil drainage refers to the frequency and duration of periods when the soil is not saturated. Terms used are - excessively, well, moderately, imperfectly and poorly drained.

droughty soil - Sandy or very rapidly drained soil.

dryland farming - The practice of crop production in low-rainfall areas without irrigation.

eolian - Material that has been deposited by wind action.

erosion - The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

evapotranspiration - The combined loss of water from a given area and during a specific period of time, by evaporation from the soil surface and by transpiration from plants.

fen - A peat-covered or peat-filled wetland with a water table which usually at or above the surface. The waters are mainly nutrient-rich, minerotrophic waters from mineral soils. The vegetation consists mainly of sedges, grasses, reeds and brown mosses with some shrub cover and at times, a scanty tree layer.

fertility, soil - The status of a soil with respect to the amount and availability of elements necessary for plant growth.

fibric - an organic layer containing large amounts of weakly decomposed material whose origins are readily identifiable.

fine texture - Consisting of or containing large quantities of the fine fractions, particularly of silt and clay.

flood plain - The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

fluvial - Material that has been transported and deposited by streams and rivers.Also alluvial.

friable - A consistency term pertaining to the ease of crumbling of soils.

frost-free period - Season of the year between the last frost of spring and first frost of fall.

Gleysolic - An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas, or prominent mottling, or both, in some horizons. The great groups Gleysol, Humic Gleysol and Luvic Gleysol are included in the order.

gravelly - Containing appreciable or significant amounts of gravel.

groundwater - That portion of the total precipitation which at any particular time is either passing through or standing in the soil and the underlying strata and is free to move under the influence of gravity.

growing degree days (GDD) - The accumulated heat units above a threshold temperature of 5 degrees C. They are calculated as (mean daily temperature - 5) x days.

horizon - A layer in the soil profile approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil forming processes. Soil horizons may be organic or mineral.

hue - One of the three variables of color. It is caused by light of certain wavelengths and changes with the wavelength.

humic - An organic layer of highly decomposed material containing little fibre.

hummocky - Abounding in rounded or conical knolls or mounds, generally of equidimensional shape and not ridge-like.

immature soil - A soil with indistinct or only slightly developed horizons.

impeded drainage - A condition which hinders the movement of water through soils under the influence of gravity.

impervious - Resistant to penetration by fluids or by roots.

indicator plants - Plants characteristic of specific soil or site conditions.

infiltration - The downward entry of water into the soil.

irrigation - The artificial application of water to the soil for the benefit of growing crops.

lacustrine - Material deposited in lake water and later exposed.

landscape - All the natural features such as fields, hills, forests, water, etc., which distinguish one part of the earth's surface from another part. Usually that portion of land or territory which the eye can comprehend in a single view, including all its natural characteristics.

lithic - A feature of a soil subgroup which indicates a bedrock contact within 50 cm of the soil surface.

loam - See soil texture. A mixture of sand, silt and clay. It is not related to color.

loose - A soil consistency term.

Luvisolic - An order of soils that have eluvial (Ae) horizons, and illuvial (Bt) horizons in which silicate clay is the main accumulation product. The soils developed under forest of forest-grassland transition in a moderate to cool climate. The Gray Luvisol great group is the most common in western Canada.

medium texture - Intermediate between fine-textured and coarse-textured (soils). (It includes the following textural classes: very fine sandy loam, loam, silt loam, and silt).

mesic - An organic layer of intermediately decomposed material (between that of fibric and humic).

moderately-coarse texture - Consisting predominantly of coarse particles. (In soil textural classification, it includes all the sandy loams except the very fine sandy loam).

moderately-fine texture - Consisting predominantly of intermediate-size (In soil textural classification, it includes clay loam, sandy clay loam, and silty clay loam).

morphology, soil - The makeup of the soil, including texture, structure, consistence, color, and other mineralogical, physical and biological properties of the various horizons of the soil profile.

Munsell color system - A color designation system that specifies the relative degree of the three simple variables of color: hue, value, and chroma. For example: 10YR 6/4 is a color (or soil) with a hue 10-YR, value -6, and chroma -4. These notations can be translated into several different systems of color names as desired. See chroma, hue, and value.

neutral soil - A soil in which the surface layer, at least to normal plow depth, is neither acid nor alkaline in reaction.

Organic - An order of soils that have developed dominantly from organic deposits. The majority of organic soils are saturated for most of the year, unless artificially drained. The great groups include Fibrisol, Mesisol, Humisol and Folisol.

organic matter - The decomposition residues of biological materials derived from: (a) plant and animal materials deposited on the surface of the soils; and (b) roots and micro-organisms that decay beneath the surface of the soil.

paralithic - Poorly consolidated bedrock which can be dug with a spade when moist. It is severely constraining but not inpenetrable to roots.

parent material - The unconsolidated and more or less chemically weathered mineral or organic matter from which the solum of a soil is developed by pedogenic processes.

particle size - The effective diameter of a particle measured by sedimentation, sieving, or micrometric methods.

peat - Unconsolidated soil material consisting largely of organic remains (mainly derived from mosses or sedges).

pedology - Those aspects of soil science involving especially the constitution, distribution, genesis and classification of soils.

percolation, soil water - The downward movement of water through soil. Especially, the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of the order of 1.0 or less.

pH, soil - The negative logarithm of the hydrogen-ion activity of a soil. The degree of acidity (or alkalinity) of a soil as determined by means of glass, quinhydrone, or other suitable electrode or indicator at a specified moisture content of soil-water ratio, and expressed in terms of the pH scale.

platy - Consisting of soil aggregates that are developed predominately along the horizontal axes, laminated; flaky.

profile, soil - A vertical section of the soil through all its horizons and extending into the parent material.

reaction, soils - The degree of acidity or alkalinity of soil, usually expressed as a pH value.

reconstructed soil - A soil profile formed by selected placement of suitable overburden materials on reshaped spoils.

Regosolic - An order of soils having no horizon development or development of the A and B horizons insufficient to meet the requirements of the other orders.Included are Regosol and Humic Regosol great groups.

residual material - Unconsolidated and partly weathered mineral materials accumulated by disintegration of consolidated rock in place.

saline soil - A nonalkali soil containing soluble salts in such quantities that they interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 dS/m (formerly mmhos/cm), the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5.

salinization - The process of accumulation of salts in soils.

sand - A soil particle between 0.05 and 2.0 mm in diameter.

saturation percentage - The amount of water required to saturate a unit of soil (often correlated with sodicity).

silt - A soil separate consisting of particles between 0.05 to 0.002 mm in equivalent diameter.

soil - The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

sodicity - A measure of the amount of sodium on the exchange complex (often expressed as sodium adsorption ratio - SAR).

soil map - A map showing the distribution of soil types or other soil mapping units in relation to the prominent physical and cultural features of the earth's surface.

soil moisture - Water contained in the soil.

soil structure - The combination or arrangement of primary soil particles into secondary particles, unit or peds. These secondary units may be, but usually are not, arranged in the profile in such a manner as to give a distinctive characteristics pattern. The secondary units are characterized and classified on the basis of size, shape, and degree of distinctness into classes, types, and grades, respectively. Common terms for kind of structure are - single grain, amorphous, blocky, subangular blocky, granular, platy, prismatic and columnar.

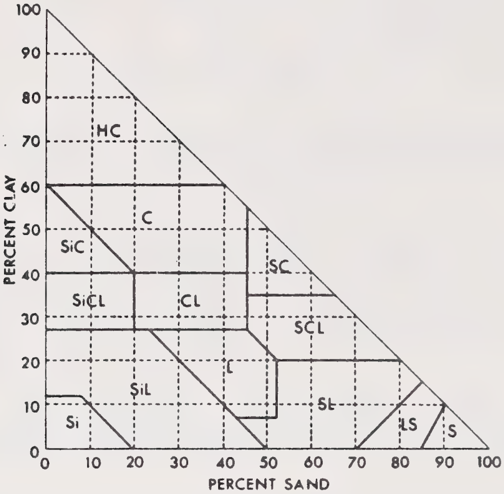
soil survey - The systematic examination, description, classification, and mapping of soils in an area. Soil surveys are ranked according to the kind and intensity of field examination.

Solonetzic - An order of soils developed mainly under grass or grass-forest vegetative cover in semiarid to subhumid climates. The soils have a stained brownish or blackish solonetzic B (Bn, Bnt) horizon and a saline C horizon. The order includes the Solonetz, Solodized Solonetz and Solod great groups.

solum (plural sola) - The upper horizons of a soil in which the parent material has been modified and within which most plant roots are confined. It consists usually of A and B horizons.

subsoil - Although a common term it cannot be defined accurately. It may be the B horizon of a soil with a distinct profile. It can also be defined as the zone below the plowed soil in which roots normally grow. In this publication it refers to the soil material between 20 cm and 100 cm depth.

texture - The relative proportions of sand, silt and clay (the soil separates). It is described in terms such as sand (S), loamy sand (LS), sandy loam (SL), loam (L), silt loam (SiL), clay loam (CL), silty clay loam (SiCL) and clay (C). See chart below.



Soil textural classes. Percentages of clay and sand in the main textural classes of soils; the remainder of each class is silt.

till - Unstratified glacial drift deposited directly by the ice and consisting of clay, sand, gravel, and boulders intermingled in any proportion.

value, color - The relative lightness of intensity of color and approximately a function of the square root of the total amount of light. One of the three variables of color.

Von Post humification scale - A manual method for estimating degree ofdecomposition of peat materials. It is a 10 point scale with assessment based on color of drained water and structure of hand squeezed material.

water table - The upper surface of groundwater or that level below which the soil is saturated with water.

weathering - The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

Appendix C. Sample Calculations

D-1. A Dark Brown Solonetzic soil landscape

1. LOCATION: SW 5-40-15 W4 (near Forestburg)

2. LANDSCAPE: gently undulating till plain

Slope characteristics: 2% slopes, about 50 m long

Pattern: 2 sloughs

Surface stoniness: slightly stony (S1), mainly stones (few cobbles)

3. SOILS: Dark Brown Solodized Solonetz on L-CL till (mainly Halkirk series)

Profile description:

horizon	depth	texture * ~~fibre~~ ~~wood~~	structure	consistence	color	
Ap	0-18	L	f. granular	friable	10YR 4/2	dk. brown
Bnt	18-55	CL	columnar to strng blocky	firm to v. firm	3/4	dk yellowish brown
Csk	55-100	L-CL	massive	firm	4/4-5/4	olive brown

*for organic soils use % rubbed fibre and % wood.

Laboratory analysis:

horizon	pH	E.C.	Sat%	SAR	CaCO3	>2mm	S	Si	C
Ap	5.5	1.4	41	3	0	2	39	42	19
Bnt	5.7	2.3	43	17	0	2	35	33	32
Csk	7.8	4.5	55	21	3	5	38	35	27

Drainage: moderately well drained

4. COMMENTS:- apart from 2 depression the landscape appears quite uniform.
- probably 20% of soils would be solods

AGRICULTURAL CAPABILITY RATING FORM (1987)

MAP AREA: SW 5-40-15 W4 NAME: RS Date: May/87

SOILS (S)

Map Component 1. ________ Name ____ % 2. ________ Name ____ %

factor	value	deduction	value	deduction
1. Surface factors				
texture (M)	L	30		
subsoil adjust.	CL	0		
structure (D)	gran	0		
org. matter (F)	Dk.Br	2		
depth (E)	18cm	0		
acidity (V)	5.5	5		
salinity (N)	1.4	0		
sodicity (Y)	—			
calcareous (K)	—			
organic (O)	—			
Basic Soil Rating =	100 -	37 = (a) 63	100 -	___ = a) ___
2. Subsoil factors (% deduction)				
structure (D)	v.firm/col	30		
depth (R,D,M)	—			
acidity (V)	7.0	0		
salinity (N)	3.5	0		
sodicity (Y)	—			
Subsoil deduction =		30% of a=b) 19	=	___% of a = b) ___
Interim Soil Rating =	a - b =	c) 44	a - b =	c) ___
3. Drainage factor (% deduction)				
drainage (W)	mod.well	0		
Drainage deduction =		0% of c=d) 0		___% of c = d) ___
Final Soil Rating(S) =	a - (b + d) =	44	S = a - (b + d) =	

LANDSCAPE (L)

Map Component 1. ________ Name ____ % 2. ________ Name ____ %

factor	value	deduction	value	deduction
1. Slope (T)				
steepness	2 %		%	
length	50 m		m	
LS factor	0.2			
region	3	5		
Basic landscape rating =	100 -	5 = a) 95	100 -	___ = a) ___
2. Stoniness (P) (% deduction)				
class	S1			
average size	>15	5		
stoniness deduction =		5% of a)=b) 5		___% of a)=b) ___
Interim landscape rating =	a - b =	c) 90	a - b =	c) ___
3. Pattern (J) (% deduction)				
number of obstacles per ¼ section	2	2		
Pattern deduction =		2% of c)=d) 2		___% of c)=d) ___
Final Landscape Rating(L) =	a - (b + d) =	88	L = a - (b + d) =	

MAP AREA: SW 5-40-15 W4 NAME: R S Date: May/87

AGROCLIMATE (C)

factor	value	deduction	
1. Moisture Component (A)			
P-PE Index	-275	23	
A = 100	-	23	= 77
2. Energy Component (H)			
E G D D Index	1280	26	
H = 100	-	26	= 74

factor	value	deduction
3. Modifying factors (% deduction)		
spring moisture	-60	0
fall moisture	-15	0
local frost	-	
hail	6	1
		b) 1 %

Basic Climate rating is lowest of Ⓐ or Ⓗ = (a) 74

Modification deduction = b% of a=c) 1

Final Climate Rating = a - c = 73

ORGANIC SOILS (O)

factor	value	deduction
1. Surface factors		
energy (EGDD)(Z)		15
decomposition(B)		
wood (I)		
nutrient st.(G)pH=		
salinity (N)		

Basic Organic Rating = 100 - ______ = a)______

factor	value	deduction
2. Subsoil factors (% of deduction)		
depth of deposit(X)		
underlying material		
presence of Ah(Y N)		
decomposition (B)		
wood (I)		
acidity (V)		
salinity (N)		

Subsoil deduction = ______% of a)=b)______

Interim soil rating = a - b = c)______

Final Organic Rating (O) = a-(b+d) = ______

factor	value	deduction
3. Drainage factor (% deduction)		
drainage (W)		

Drainage deduction = ______% of c)=d______

FINAL RATING CALCULATION

	index			factors		%
C =	73	or class	2,	H	A	( )
S =	44	or class	4,	D	A	( )
S =		or class	,			( )
O =		or class	,			( )
L =	88	or class	1,			( )
L =		or class	,			( )

Index	Class
80 - 100	1
60 - 79	2
45 - 59	3
30 - 44	4
20 - 29	5
10 - 19	6
0 - 9	7

Most limiting component = S at an index of 44 or class 4

Other significant components are C at an index of 73 or class 2

and ______ at an index of ______ or class ______

Symbol

	C	S(O)	L				%
4	2	4	1	D	A		( )
Class	classes			factors			

Comments

4DA

	C	S(O)	L				
							( )
Class	classes			factors			

D-2. A Black Chernozemic soil landscape

1. LOCATION: NE 15-56-20 W4 (near Bruderheim)

2. LANDSCAPE: undulating fluvial landscape

   Slope characteristics: 5% slopes, about 50 m long

   Pattern: —

   Surface stoniness: —

3. SOILS: Black on sandy material
   (Peace Hills series)

Profile description:

horizon	depth	texture * ~~fibre~~ ~~wood~~	structure	consistence	color
Ah	0-30	SL-LS	weak gran.	loose to friable	10YR 3/1
Bm	30-70	SL	prismatic	friable	5/4
Ck	70-110	SL-LS	single grain	loose	5/3

*for organic soils use % rubbed fibre and % wood.

Laboratory analysis:

horizon	pH	E.C.	Sat%	SAR	CaCO3	>2mm	S	Si	C
Ah	7.2				—		68	20	12
Bm	6.3				—	2	60	24	16
Ck	7.7				5		73	17	10

Drainage: very well drained

4. COMMENTS: average depth of Ah probably closer to 15 cm with some quite thin knolls.

AGRICULTURAL CAPABILITY RATING FORM (1987)

MAP AREA: NE 15-56-20 W4 NAME: AF Date: May /87

SOILS (S)

Map Component 1. ______ Name ______ % | 2. ______ Name ______ %

factor	value	deduction	value	deduction
1. Surface factors				
texture (M)	SL-LS	35		
subsoil adjust.	SL	0		
structure (D)	gran	0		
org. matter (F)	black	0		
depth (E)	30 cm	0		
acidity (V)	7.2	0		
salinity (N)	–			
sodicity (Y)	–			
calcareous (K)	–			
organic (O)	–			

Basic Soil Rating = 100 - 35 = (a) 65 | 100 - ___ = a) ___

2. Subsoil factors (% deduction)				
structure (D)	pris/fri	0		
depth (R,D,M)	–			
acidity (V)	6.5	0		
salinity (N)	–			
sodicity (Y)	–			

Subsoil deduction = 0 % of a=b) – | = ___ % of a = b) ___

Interim Soil Rating = a - b = c) 65 | a - b = c) ___

3. Drainage factor (% deduction)				
drainage (W)	well	0		

Drainage deduction = 0 % of c=d) – | ___ % of c = d) ___

Final Soil Rating(S) = a - (b + d) = 65 | S = a - (b + d) = ___

LANDSCAPE (L)

Map Component 1. ______ Name ______ % | 2. ______ Name ______ %

factor	value	deduction	value	deduction
1. Slope (T)				
steepness	5 %		%	
length	50 m		m	
LS factor	0.7			
region	3	25		

Basic landscape rating = 100 - 25 = a) 75 | 100 - ___ = a) ___

2. Stoniness (P) (% deduction)				
class	0			
average size	–			

stoniness deduction = ___ % of a)=b) – | ___ % of a)=b) ___

Interim landscape rating = a - b = c) 75 | a - b = c) ___

3. Pattern (J) (% deduction)				
number of obstacles per ¼ section	0			

Pattern deduction = ___ % of c)=d) – | ___ % of c)=d) ___

Final Landscape Rating(L) = a - (b + d) = 75 | L = a - (b + d) = ___

MAP AREA: NE15- 56-20 W4 NAME: A F Date: May/87

AGROCLIMATE (C)

factor	value	deduction	
1. Moisture Component (A)			
P-PE Index	-230	16	
A = 100	-	16	= 84
2. Energy Component (H)			
E G D D Index	1220	36	
H = 100	-	36	= 64

factor	value	deduction
3. Modifying factors (% deduction)		
spring moisture	-60	0
fall moisture	-5	0
local frost	–	
hail	5	0
		b) 0 %

Basic Climate rating is lowest of A or [✓ H] = (a) 64

Modification deduction = b% of a=c) –

Final Climate Rating = a - c = 64

ORGANIC SOILS (O)

factor	value	deduction
1. Surface factors		
energy (EGDD)(Z)		15
decomposition(B)		
wood (I)		
nutrient st.(G)pH=		
salinity (N)		

Basic Organic Rating = 100 - ______ = a)______

factor	value	deduction
2. Subsoil factors (% of deduction)		
depth of deposit(X)		
underlying material		
presence of Ah(Y N)		
decomposition (B)		
wood (I)		
acidity (V)		
salinity (N)		

Subsoil deduction = ______% of a)=b)______

Interim soil rating = a - b = c)______

factor	value	deduction
3. Drainage factor (% deduction)		
drainage (W)		

Drainage deduction = ______% of c)=d______

Final Organic Rating (O) = a-(b+d) =

FINAL RATING CALCULATION

	index			factors		%
C =	64	or class	2,	H		( )
S =	65	or class	2,	m		( )
S =		or class	,			( )
O =		or class	,			( )
L =	25	or class	2,	T		( )
L =		or class	,			( )

Index	Class
80 - 100	1
60 - 79	2
45 - 59	3
30 - 44	4
20 - 29	5
10 - 19	6
0 - 9	7

Most limiting component = C at an index of 64 or class 2

Other significant components are S at an index of 65 or class 2

and L at an index of 25 or class 2

Symbol

2	C	S(O)	L				%
Class	2	2	2	M	T	H	( )
	classes			factors			

Comments

2 MTH

	C	S(O)	L				
Class							( )
	classes			factors			

D-3. A Gray Luvisolic soil landscape

1. LOCATION: SW 4 - 75 - 22 W5

2. LANDSCAPE: very gently sloping lacustrine plain

   Slope characteristics: 1% slopes (2% near depressions), 200 m

   Pattern: 2 small wet areas, 1 large bog in corner

   Surface stoniness: —

3. SOILS: Dark Gray and Gray Luvisolic soils on clayey materials (an Esher - Donnelly soil area)

   Profile description: Gleyed Solonetzic Gray Luvisol (Dark)

horizon	depth	texture * ~~fibre wood~~	structure	consistence	color
Ahe	0-10	SiL	granular	friable	10YR 4/2
Ae	10-25	SiL	co. platy	friable-firm	10YR 7/2
Bt(nj)	35-70	C	st. blocky	firm - v. firm	10YR 4/4
Csk	70-100	SiCL	massive	firm	2.5Y 5/2

*for organic soils use % rubbed fibre and % wood.

Laboratory analysis:

horizon	pH	E.C.	Sat%	SAR	CaCO3	>2mm	S	Si	C
Ahe	5.7	–		–	–		27	59	14
Ae	5.5	–		–	–		12	73	15
Bt(nj)	5.0	1		–	–		10	34	56
Csk	7.5	4		10	1		10	54	38

Drainage:

4. COMMENTS:

AGRICULTURAL CAPABILITY RATING FORM (1987)

MAP AREA: SW 4-75-22 W5 NAME: CM Date: May/87

SOILS (S)

Map Component	1. Name: Dark Gray	%: 70		2. Name: Gray Luv.	%: 30
factor	value	deduction		value	deduction
1. Surface factors					
texture (M)	Si L	16		Si L	16
subsoil adjust.	CL-C	0		C	0
structure (D)	gran	0		fr/platy	5
org. matter (F)	Dk.Gr.	2		gray	10
depth (E)	10 cm	10		3 cm	20
acidity (V)	5.5	5		5.5	5
salinity (N)	–			–	
sodicity (Y)	–			–	
calcareous (K)	–			–	
organic (O)	–			–	
Basic Soil Rating =	100 -	33 =	(a) 67	100 - 56 =	a) 44
2. Subsoil factors (% deduction)					
structure (D)	firm/subang	10		firm/blocky	15
depth (R,D,M)	–			–	
acidity (V)	5.5	2		5.0	5
salinity (N)	–			–	
sodicity (Y)	–			–	
Subsoil deduction =		12 % of a=b)	8	= 20 % of a = b)	9
Interim Soil Rating =	a - b =		c) 59	a - b =	c) 35
3. Drainage factor (% deduction)					
drainage (W)	mod.well	0		mod well	0
Drainage deduction =		% of c=d)	–	% of c = d)	–
Final Soil Rating(S) =	a - (b + d) =		$\boxed{59}$	S = a - (b + d) =	$\boxed{35}$

LANDSCAPE (L)

Map Component	1. Name: Upland	%: 100		2. Name:	%:
factor	value	deduction		value	deduction
1. Slope (T)					
steepness	1 %			%	
length	200 m			m	
LS factor	0.2				
region	1	15			
Basic landscape rating =	100 -	15 =	a) 85	100 - =	a)
2. Stoniness (P) (% deduction)					
class	0				
average size					
stoniness deduction =		% of a)=b)	–	% of a)=b)	
Interim landscape rating =	a - b =		c) 85	a - b =	c)
3. Pattern (J) (% deduction)					
number of obstacles per ¼ section	3	3			
Pattern deduction =		3 % of c)=d)	3	% of c)=d)	
Final Landscape Rating(L) =	a - (b + d) =		$\boxed{82}$	L = a - (b + d) =	$\boxed{}$

MAP AREA: 5W4 - 75 - 22 W5 NAME: C M Date: May/87

AGROCLIMATE (C)

factor	value	deduction		factor	value	deduction
1. Moisture Component (A)				3. Modifying factors (% deduction)		
P-PE Index	-230	16		spring moisture	-60	0
A = 100	-	16 = 84		fall moisture	0	0
2. Energy Component (H)				local frost	–	
E G D D Index	1200	38		hail	4	0
H = 100	-	38 = 62				b) 0%

Basic Climate rating is lowest of A or [✓ H] = (a) 62

Modification deduction = b% of a=c) –

Final Climate Rating = a - c = 62

ORGANIC SOILS (O)

factor	value	deduction
1. Surface factors		
energy (EGDD)(Z)		15
decomposition(B)		
wood (I)		
nutrient st.(G)pH=		
salinity (N)		

Basic Organic Rating = 100 - ____ = a)____

factor	value	deduction
2. Subsoil factors (% of deduction)		
depth of deposit(X)		
underlying material		
presence of Ah(Y N)		
decomposition (B)		
wood (I)		
acidity (V)		
salinity (N)		

Subsoil deduction = ____% of a)=b)____

Interim soil rating = a - b = c)____

factor	value	deduction
3. Drainage factor (% deduction)		
drainage (W)		

Drainage deduction = ____% of c)=d____

Final Organic Rating (O) = a-(b+d) =

FINAL RATING CALCULATION

	index			factors		%
C =	62	or class	2,	H		( )
S =	59	or class	3,	A		(70)
S =	35	or class	4,	E	D	(30)
O =		or class	,			( )
L =	82	or class	1,			( )
L =		or class	,			( )

Index	Class
80 - 100	1
60 - 79	2
45 - 59	3
30 - 44	4
20 - 29	5
10 - 19	6
0 - 9	7

Most limiting component = S at an index of 35 or class 4

Other significant components are S at an index of 59 or class 3

and C at an index of 62 or class 2

Symbol

	C	S(O)	L	factors			%
3 Class	2	3	1	E	D	A	( )
	classes						

	C	S(O)	L	factors			
Class							( )
	classes						

Comments

Soil complex should be averaged.

$\frac{70}{100} \times 59 + \frac{30}{100} \times 35 = \underline{\underline{52}}$

3 EDA

D-4. A Gleysolic soil landscape

1. LOCATION: SE 15- 101- 24 W5 (near Keg River)

2. LANDSCAPE: almost level

   Slope characteristics: 1% slope, 300m long

   Pattern: —

   Surface stoniness: —

3. SOILS: Gleysolic (meadow) soils with a thin peaty surface

Profile description:

horizon	depth	texture *		structure	consistence	color	
		fibre	wood				
Om	15-0	mesic 15%	—	felted	friable	10YR 3/3	dark brown
Ahg	0-10	SiCL		Co. gran.	friable	10YR 2/1	black
Bg	10-40	C		massive	firm	10YR 4/1	dark gray
Cg	40+	C		massive	firm	5Y 4/1	

*for organic soils use % rubbed fibre and % wood.

Laboratory analysis:

horizon	pH	E.C.	Sat%	SAR	CaCO3	>2mm	S	Si	C
Om	7.0								
Ahg	7.2						3	61	36
Bg	7.0						0	20	80
Cg	7.0	—			—		0	21	79

Drainage: poorly drained but if provided with
surface drains could probably cultivate

4. COMMENTS: 8 years out of 10.

AGRICULTURAL CAPABILITY RATING FORM (1987)

MAP AREA: SE 15-101-24 W5 NAME: A T Date: May/87

SOILS (S)

Map Component 1.	Name	%	2.	Name	%
factor	value	deduction		value	deduction
1. Surface factors					
texture (M)	Si CL	18			
subsoil adjust.	C	0			
structure (D)	gran	0			
org. matter (F)	black	0			
depth (E)	10 cm	10			
acidity (V)	7.2	0			
salinity (N)	–				
sodicity (Y)	–				
calcareous (K)	–				
organic (O)	15 cm/Fm	10			

Basic Soil Rating = 100 - 38 = (a) 62 100 - ___ = a)___

2. Subsoil factors (% deduction)				
structure (D)	firm/mass	10		
depth (R,D,M)	–			
acidity (V)	–			
salinity (N)	–			
sodicity (Y)	–			

Subsoil deduction = 10 % of a=b) 6 = ___ % of a = b)___

Interim Soil Rating = a - b = c) 56 a - b = c)___

3. Drainage factor (% deduction)

drainage (W) poor 25 ___ ___

Drainage deduction = 25 % of c=d) 14 ___ % of c = d)___

Final Soil Rating(S) = a - (b + d) = $\boxed{42}$ S = a - (b + d) = ☐

LANDSCAPE (L)

Map Component 1.	Name	%	2.	Name	%
factor	value	deduction		value	deduction
1. Slope (T)					
steepness	1 %			%	
length	300 m			m	
LS factor	0.2				
region	1	15			

Basic landscape rating = 100 - 15 = a) 85 100 - ___ = a)___

2. Stoniness (P) (% deduction)				
class	0			
average size				

stoniness deduction = ___ % of a)=b) – ___ % of a)=b)___

Interim landscape rating = a - b = c) 85 a - b = c)___

3. Pattern (J) (% deduction)

number of obstacles per ¼ section 0 ___ ___

Pattern deduction = ___ % of c)=d) – ___ % of c)=d)___

Final Landscape Rating(L) = a - (b + d) = $\boxed{85}$ L = a - (b + d) = ☐

MAP AREA: SE 15-101-24 W5 NAME: A T Date: May/87

AGROCLIMATE (C)

factor	value	deduction	
1. Moisture Component (A)			
P-PE Index	-250	18	
A = 100	-	18	= 82
2. Energy Component (H)			
E G D D Index	1020	60	
H = 100	-	60	= 40

factor	value	deduction
3. Modifying factors (% deduction)		
spring moisture	-50	0
fall moisture	+10	1
local frost	—	
hail	4	0
		b) 1 %

Basic Climate rating is lowest of A or [✓ H] = (a) 40

Modification deduction = b% of a=c) 0.4

Final Climate Rating = a - c = $\boxed{40}$

ORGANIC SOILS (O)

factor	value	deduction
1. Surface factors		
energy (EGDD)(Z)		15
decomposition(B)		
wood (I)		
nutrient st.(G)pH=		
salinity (N)		

Basic Organic Rating = 100 - ____ = a)____

2. Subsoil factors (% of deduction)		
depth of deposit(X)		
underlying material		
presence of Ah(Y N)		
decomposition (B)		
wood (I)		
acidity (V)		
salinity (N)		

Subsoil deduction = ____% of a)=b)____

Interim soil rating = a - b = c)____

factor	value	deduction
3. Drainage factor (% deduction)		
drainage (W)		

Drainage deduction = ____% of c)=d____

Final Organic Rating (O) = a-(b+d) = ☐

FINAL RATING CALCULATION

	index			factors		%
C =	40	or class	4,	H		( )
S =	42	or class	4,	D	W	( )
S =		or class	,			( )
O =		or class	,			( )
L =	85	or class	1,			( )
L =		or class	,			( )

Index	Class
80 - 100	1
60 - 79	2
45 - 59	3
30 - 44	4
20 - 29	5
10 - 19	6
0 - 9	7

Most limiting component = C at an index of 40 or class 4

Other significant components are S at an index of 42 or class 4

and ____ at an index of ____ or class ____

Symbol

	C	S(O)	L		factors		%
4 Class	4	4	1	D	W	H	( )

classes

Comments

4DWH

	C	S(O)	L		factors		%
Class							( )

classes

D-5. An Organic soil landscape

1. LOCATION: NE 30-62-2 W5 (near Vega)

2. LANDSCAPE: level organic area

   Slope characteristics: 0

   Pattern: –

   Surface stoniness: –

3. SOILS: mixture of mesic and fibric organic soils – mostly black spruce forest (Eaglesham-Kenzie soil area)

Profile description:

horizon	depth	texture *		structure	consistence	color
		fibre	wood			
Of	0-60	80%	–	spongy	fibric	10YR 5/6
Om	60-110	35%	2	felty	mesic	5YR 3/4
Oh	110-150	5%	–	massive	humic	5YR 2/2
Cg		SiL				

* for organic soils use % rubbed fibre and % wood.

Laboratory analysis:

horizon	pH	E.C.	Sat%	SAR	$CaCO_3$	>2mm	S	Si	C
Of	4								
Om	5								
Oh	6								

Drainage: very poorly drained. uncontrolled water table is usually below the surface

4. COMMENTS:

tree cover is variable with some areas of more shrubs and sedges

AGRICULTURAL CAPABILITY RATING FORM (1987)

MAP AREA: NE 30 - 62 - 2 W5 NAME: L M Date: May/87

SOILS (S)

Map Component 1. ______ Name ______ % 2. ______ Name ______ %

factor	value	deduction	value	deduction
1. Surface factors				
texture (M)				
subsoil adjust.				
structure (D)				
org. matter (F)				
depth (E)				
acidity (V)				
salinity (N)				
sodicity (Y)				
calcareous (K)				
organic (O)				
Basic Soil Rating =	100 -	____ = (a) ____	100 -	____ = a) ____
2. Subsoil factors (% deduction)				
structure (D)				
depth (R,D,M)				
acidity (V)				
salinity (N)				
sodicity (Y)				
Subsoil deduction =		____% of a=b) ____	=	____% of a = b) ____
Interim Soil Rating =	a - b =	c) ____	a - b =	c) ____
3. Drainage factor (% deduction)				
drainage (W)				
Drainage deduction =		____% of c=d) ____		____% of c = d) ____
Final Soil Rating(S) =	a - (b + d) =	☐	S = a - (b + d) =	☐

LANDSCAPE (L)

Map Component 1. Wetland Name ______ % 2. ______ Name ______ %

factor	value	deduction	value	deduction
1. Slope (T)				
steepness	0 %		____%	
length	____m		____m	
LS factor				
region				
Basic landscape rating =	100 - 0	= a) 100	100 -	____ = a) ____
2. Stoniness (P) (% deduction)				
class	—			
average size				
stoniness deduction =		____% of a)=b) —		____% of a)=b) ____
Interim landscape rating =	a - b =	c) 100	a - b =	c) ____
3. Pattern (J) (% deduction)				
number of obstacles per ¼ section	—			
Pattern deduction =		____% of c)=d) —		____% of c)=d) ____
Final Landscape Rating(L) =	a - (b + d) =	100	L = a - (b + d) =	☐

MAP AREA: NE 30 – 62 – 2 W5 NAME: L M Date: May/87

AGROCLIMATE (C)

factor	value	deduction	
1. Moisture Component (A)			
P-PE Index	–190	12	
A = 100	-	12	= 88
2. Energy Component (H)			
E G D D Index	1120	50	
H = 100	-	50	= 50

factor	value	deduction
3. Modifying factors (% deduction)		
spring moisture	–45	1
fall moisture	–5	0
local frost	–	
hail	8	3
	b)	4%

Basic Climate rating is lowest of A or [✓ H] = (a) 50

Modification deduction = b% of a=c) 2

Final Climate Rating = a - c = 48

ORGANIC SOILS (O)

factor	value	deduction
1. Surface factors		
energy (EGDD)(Z)		15
decomposition(B)	80% fib	20
wood (I)	0	0
nutrient st.(G)pH=	4	40
salinity (N)	–	

Basic Organic Rating = 100 - 75 = a) 25

factor	value	deduction
2. Subsoil factors (% of deduction)		
depth of deposit(X)	150 cm	
underlying material	Si L	50
presence of Ah(Y N)	N	–
decomposition (B)	ave=40%	5
wood (I)	2	0
acidity (V)	ave=4.8	2
salinity (N)		

Subsoil deduction = 57% of a)=b) 14

Interim soil rating = a - b = c) 11

factor	value	deduction
3. Drainage factor (% deduction)		
drainage (W)	v. poor	70

Drainage deduction = 70% of c)=d 7

Final Organic Rating (O) = a-(b+d) = 4

FINAL RATING CALCULATION

	index			factors		%
C =	48	or class	3,	H		( )
S =		or class	,			( )
S =		or class	,			( )
O =	4	or class	7,	W	X	( )
L =	100	or class	1,			( )
L =		or class	,			( )

Index	Class
80 - 100	1
60 - 79	2
45 - 59	3
30 - 44	4
20 - 29	5
10 - 19	6
0 - 9	7

Most limiting component = O at an index of 4 or class 7

Other significant components are C at an index of 48 or class 3

and ___ at an index of ___ or class ___

Symbol

	C	S(O)	L	factors			%
7 Class	3	7	1	W	X	H	( )
	classes						

	C	S(O)	L	factors			%
Class							( )
	classes						

Comments

7 W X (H)

Rating is for the most limiting component

D-6. A complex soil landscape

1. LOCATION: NW 35 - 49 - 4 W5

2. LANDSCAPE: hummocky till

Slope characteristics: 12 % slopes, 60 m long

Pattern: 8 wet areas

Surface stoniness: stony 1, some large

3. SOILS: mostly Gray Luvisols with about 30% bog (Hubalta- Eaglesham)

Profile description: well drained component

horizon	depth	texture * ~~fibre~~ ~~wood~~	structure	consistence	color
L-H	5-0	leaf litter			
Ah	0-2	L	wk. gran.	friable	4.5/2
Ae	2-20	SiL	platy	friable	6/2
AB	20-30	SiCL	subang.	firm	4/3
Bt	30-80	C	blocky	firm+	4/2
BC	80-100	CL	massive	firm	4/2

*for organic soils use % rubbed fibre and % wood.

Laboratory analysis:

horizon	pH	E.C.	Sat%	SAR	CaCO3	>2mm	S	Si	C
Ae	6.0					2	18	70	12
Bt	5.0					2	31	28	41
BC	7.0					2	32	36	32

Drainage: -50% well, 20% imperfect, 30 % poor
-a lot of undrained depressions

4. COMMENTS:

D-6. continued

1. LOCATION: NW 35-49-4 W5

2. LANDSCAPE:

   Slope characteristics:

   Pattern:

   Surface stoniness:

3. SOILS:

Profile description: poorly drained component

horizon	depth	texture *		structure	consistence	color
		fibre	wood			
Om	0-50	30	1	felted	friable	3/2
Oh	50-70	5	—	massive	friable	2/1
Cg	70+	SiCL		massive	firm	2.5Y 5/2

*for organic soils use % rubbed fibre and % wood.

Laboratory analysis:

horizon	pH	E.C.	Sat%	SAR	CaCO3	>2mm	S	Si	C
Om	6.5								
Oh									
Cg	6.5						10	50	40

Drainage: very poorly drained - enclosed depressions

4. COMMENTS: some of the peats are quite shallow - often less than 30 cm.

AGRICULTURAL CAPABILITY RATING FORM (1987)

MAP AREA: SW 35-49-4W5 NAME: WP Date: May/87

SOILS (S)

Map Component	1. Upland	70		2.		
	Name	%		Name	%	
factor	value	deduction		value	deduction	
1. Surface factors						
texture (M)	SiL	20				
subsoil adjust.	C	0				
structure (D)	fr/platy	5				
org. matter (F)	gray	10				
depth (E)	<5	20				
acidity (V)	6.0	2				
salinity (N)	—					
sodicity (Y)	—					
calcareous (K)	—					
organic (O)	—					
Basic Soil Rating =	100 -	44 =	(a) 56	100 -	=	a)
2. Subsoil factors (% deduction)						
structure (D)	firm/blocky	10				
depth (R,D,M)	—					
acidity (V)	5.0	5				
salinity (N)	—					
sodicity (Y)	—					
Subsoil deduction =		15 % of a=b)	8	=	% of a = b)	
Interim Soil Rating =	a - b =		c) 48	a - b =		c)
3. Drainage factor (% deduction)						
drainage (W)	Well	0				
Drainage deduction =		% of c=d)	—		% of c = d)	
Final Soil Rating(S) =	a - (b + d) =		48	S = a - (b + d) =		

LANDSCAPE (L)

Map Component	1. Upland	70		2. Wetland	30	
	Name	%		Name	%	
factor	value	deduction		value	deduction	
1. Slope (T)						
steepness	12 %			0-2 %		
length	60 m			20-50 m		
LS factor	2.5			0.15		
region	3-2	55		3-2	5	
Basic landscape rating =	100 -	55 =	a) 45	100 -	5 =	a) 95
2. Stoniness (P) (% deduction)						
class	S1			—		
average size	stones	5				
stoniness deduction =		5 % of a)=b)	2		% of a)=b)	—
Interim landscape rating =	a - b =		c) 43	a - b =		c) 95
3. Pattern (J) (% deduction)						
number of obstacles per ¼ section	8	8		—		
Pattern deduction =		8 % of c)=d)	3		% of c)=d)	—
Final Landscape Rating(L) =	a - (b + d) =		40	L = a - (b + d) =		95

MAP AREA: SW35-49-4 W5 NAME: W P Date: May/87

AGROCLIMATE (C)

factor	value	deduction	
1. Moisture Component (A)			
P-PE Index	-150	7	
A = 100	-	7	= 93
2. Energy Component (H)			
E G D D Index	1080	55	
H = 100	-	55	= 45

factor	value	deduction
3. Modifying factors (% deduction)		
spring moisture	-45	1
fall moisture	-5	0
local frost	–	
hail	8	3
	b)	4 %

Basic Climate rating is lowest of A or [✓ H] = (a) 45

Modification deduction = b% of a=c) 2

Final Climate Rating = a - c = $\boxed{43}$

ORGANIC SOILS (0)

factor	value	deduction
1. Surface factors		
energy (EGDD)(Z)		15
decomposition(B)	mesic	10
wood (I)	1%	0
nutrient st.(G)pH=	6.5	10
salinity (N)		

Basic Organic Rating = 100 - 20 = a) 80

factor	value	deduction
2. Subsoil factors (% of deduction)		
depth of deposit(X)	70-30	
underlying material	SiCL	15
presence of Ah(Y N)	N	5
decomposition (B)	ave 20%	5
wood (I)	0	0
acidity (V)	–	
salinity (N)	–	

Subsoil deduction = 25% of a)=b) 20

Interim soil rating = a - b = c) 60

factor	value	deduction
3. Drainage factor (% deduction)		
drainage (W)	v poor	20

Drainage deduction = 20 % of c)=d 42

Final Organic Rating (0) = a-(b+d) = $\boxed{18}$

FINAL RATING CALCULATION

	index			factors		%
C =	43	or class	4,	H		( )
S =	48	or class	3,	E		(70)
S =		or class	,			( )
0 =	18	or class	6,	W		(30)
L =	40	or class	4,	T		(70)
L =	95	or class	1,			(30)

Index	Class
80 - 100	1
60 - 79	2
45 - 59	3
30 - 44	4
20 - 29	5
10 - 19	6
0 - 9	7

Most limiting component = 0 at an index of 18 or class 6
Other significant components are L at an index of 40 or class 4
and C at an index of 43 or class 4
S 48 3

Symbol

Class	C	S(0)	L	factors			%
4	4	3	4	T	E	H	(70)
6	4	6	1	W	H		(30)

Comments

$4^{7}_{TEH}\quad 6^{3}W(H)$

Comments on the Agriculture Capability Rating System

1.General format ....
....

-are there any other sections or topics which should be included? ....

-please list ....
....
....

-are there any sections which should be deleted?......

-please list ....
....
....

second

fold

2. Specific components

component- ....
comments - ....
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comments - ....
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component- ....
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first

fold

3. General comments ....
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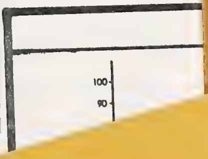
Secretary
Alberta Soils Advisory Committee
c/o Soils Branch
Alberta Agriculture
7000 - 113 Street
Edmonton, Alberta
T6H 5T6

staple

NORTHWEST TERRITORIES
-60
-60
-60
32ND BASE LINE
31ST BASE LINE
30TH BASE LINE
29TH BASE LINE
Bistcho Lake
RAINBOW LAKE
HIGH LEVEL
WOOD
BUFFALO
NATIONAL
River
Margaret L
Wentzel Lake
Andrew Lake
Cornwall Lake
Colin L
B I A



100
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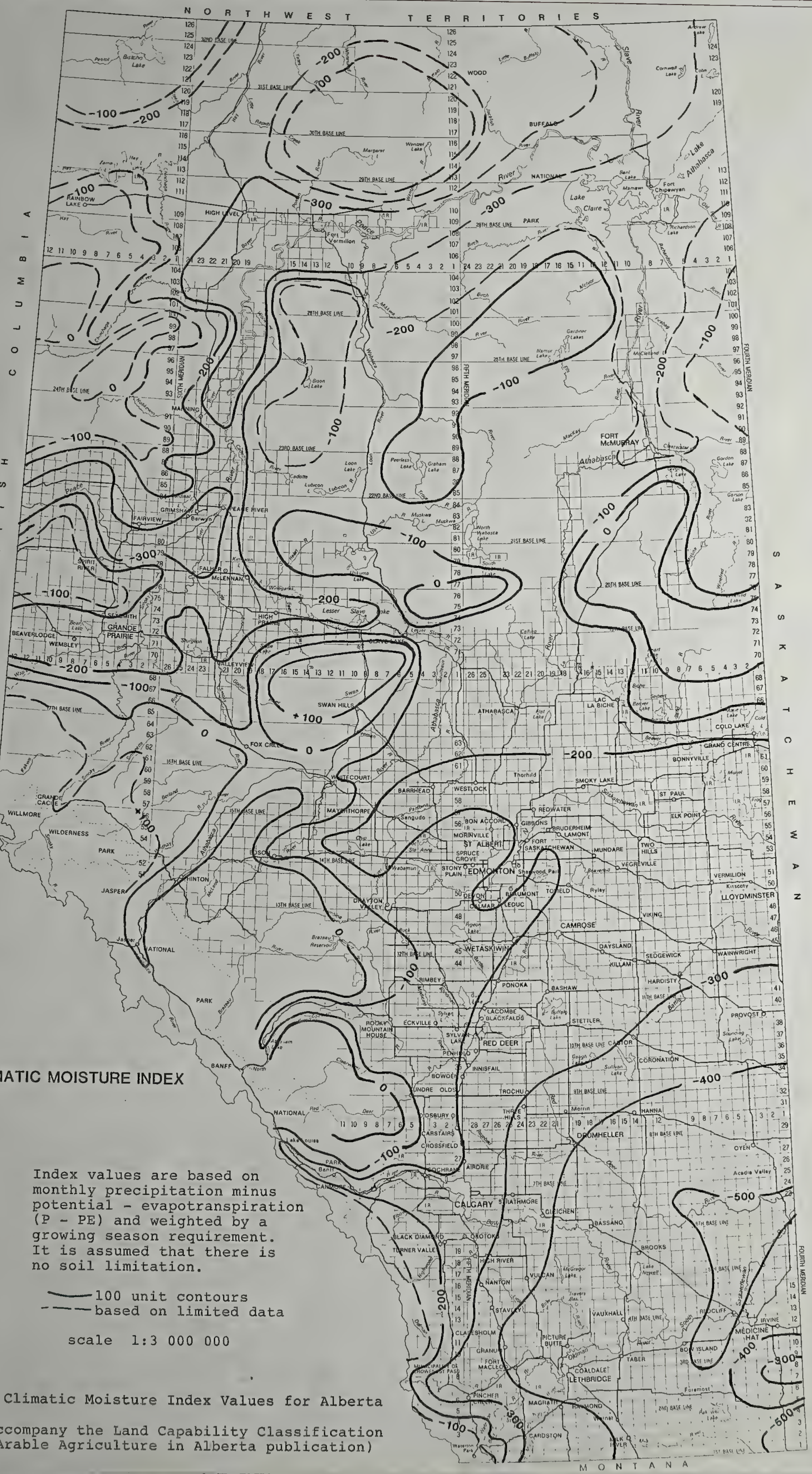


CLIMATIC MOISTURE INDEX

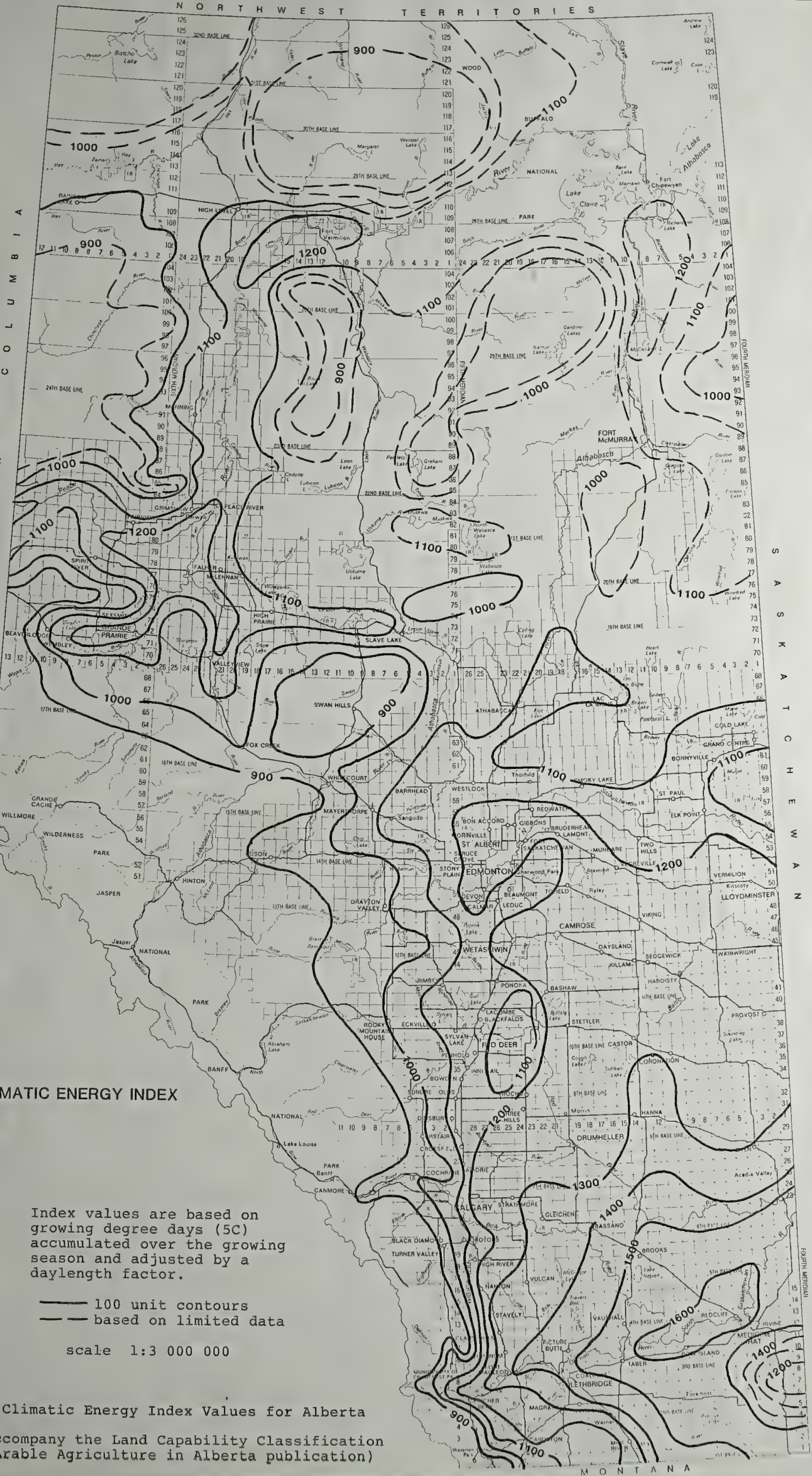
Index values are based on monthly precipitation minus potential - evapotranspiration (P - PE) and weighted by a growing season requirement. It is assumed that there is no soil limitation.

—— 100 unit contours
– – – based on limited data

scale 1:3 000 000

MAP 1. Climatic Moisture Index Values for Alberta

(to accompany the Land Capability Classification for Arable Agriculture in Alberta publication)



Index values are based on growing degree days (5C) accumulated over the growing season and adjusted by a daylength factor.

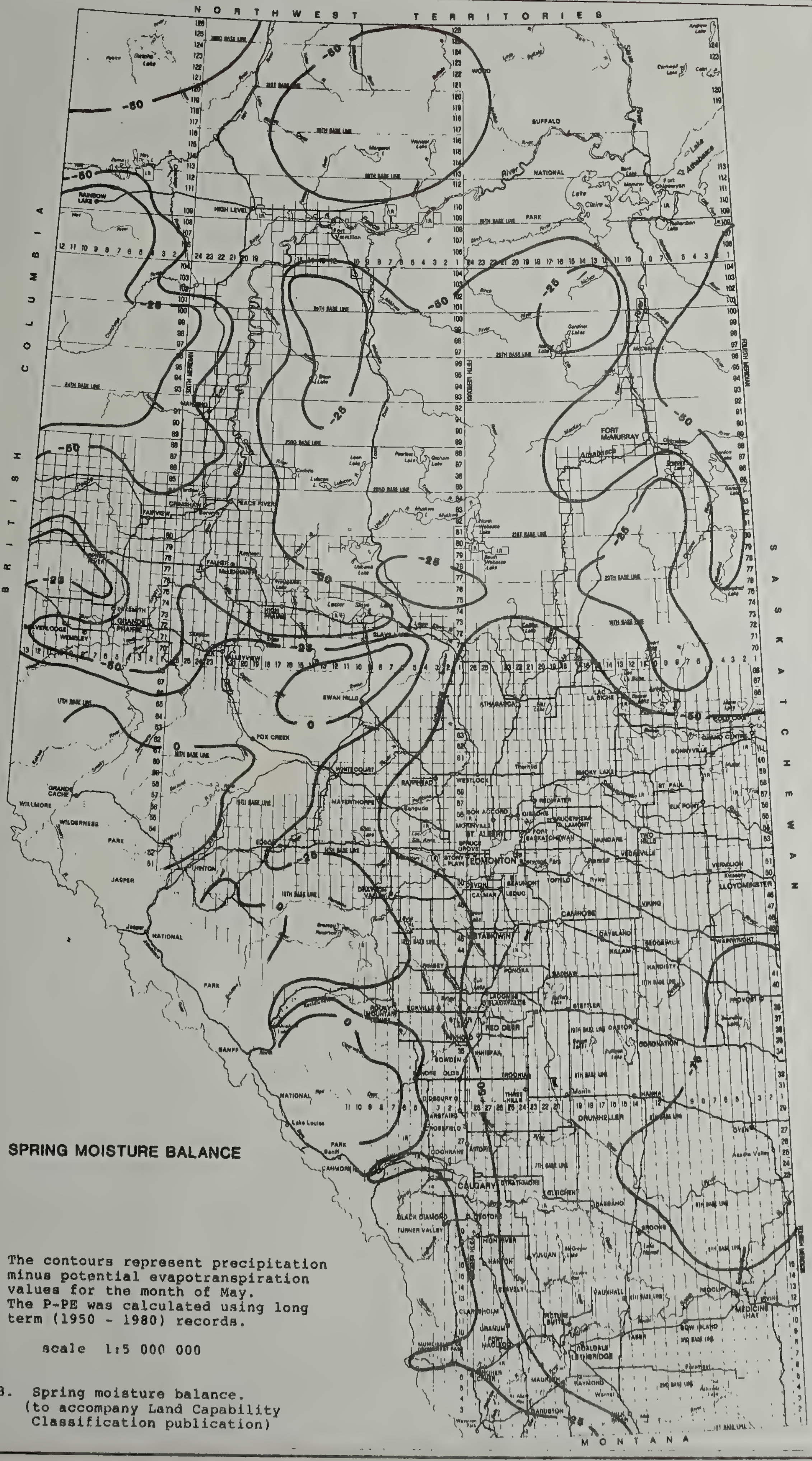
—— 100 unit contours

– – based on limited data

scale 1:3 000 000

MAP 2. Climatic Energy Index Values for Alberta

(to accompany the Land Capability Classification for Arable Agriculture in Alberta publication)

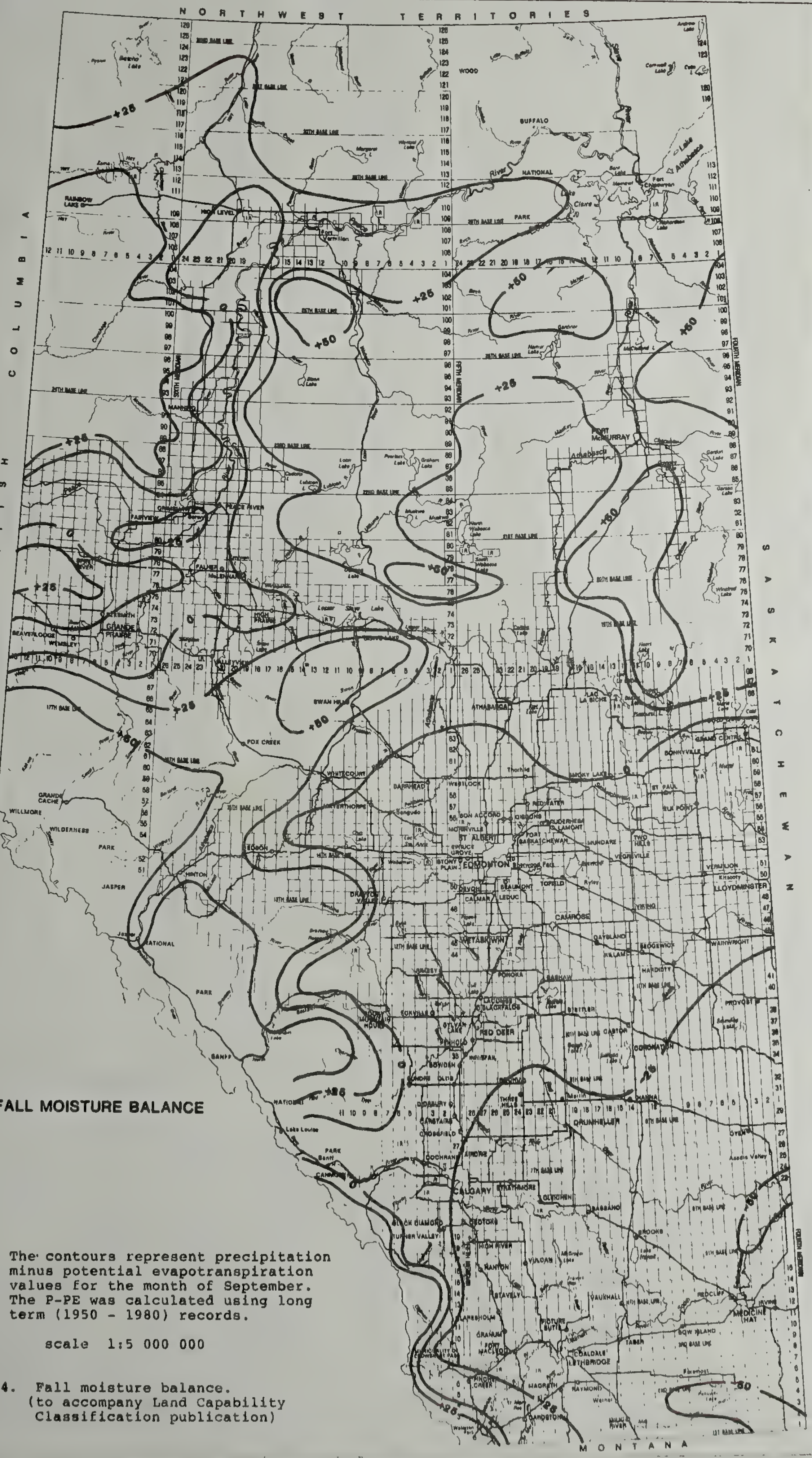


SPRING MOISTURE BALANCE

The contours represent precipitation minus potential evapotranspiration values for the month of May.
The P-PE was calculated using long term (1950 - 1980) records.

scale 1:5 000 000

Map 3. Spring moisture balance.
(to accompany Land Capability Classification publication)

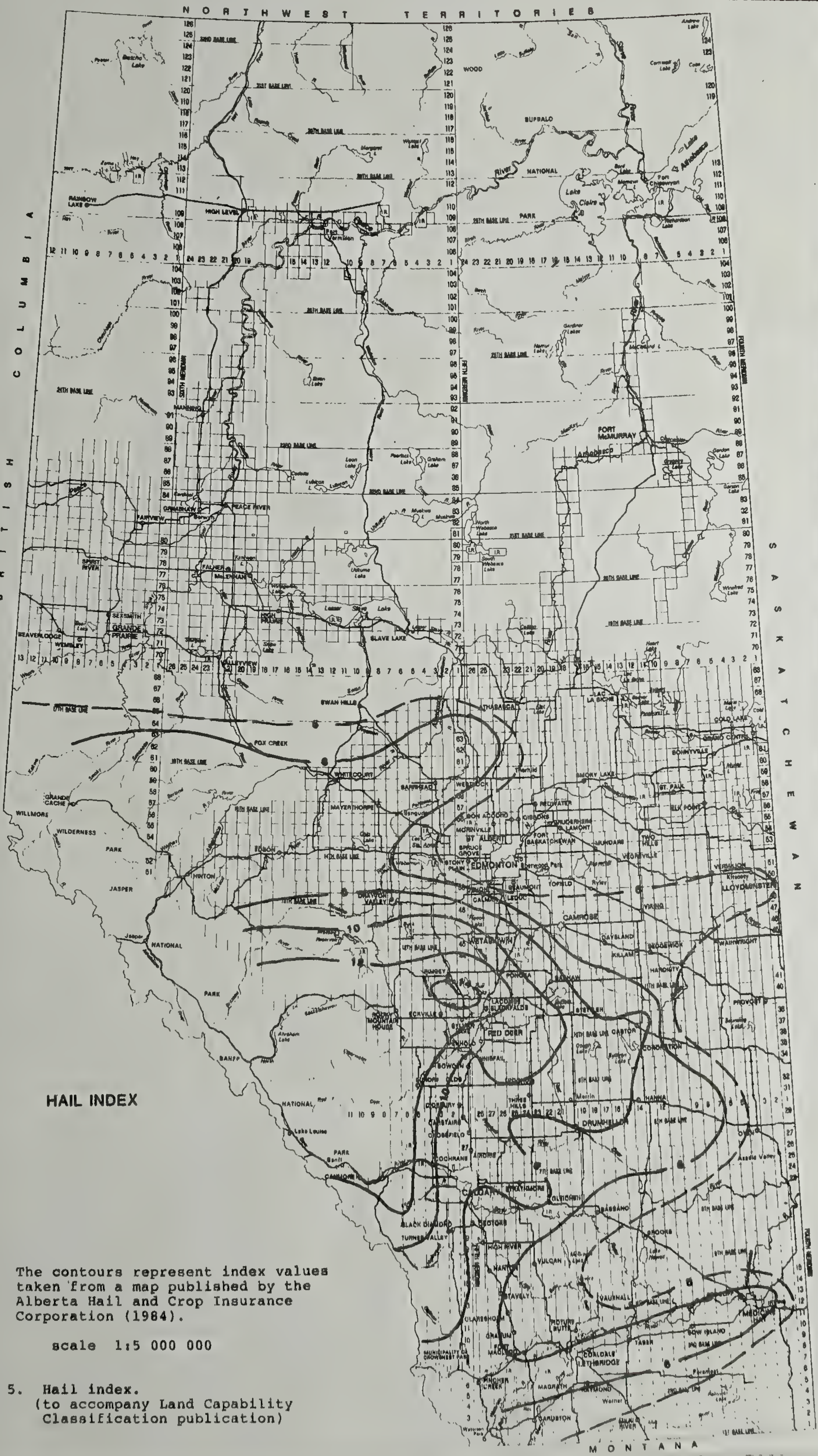


FALL MOISTURE BALANCE

The contours represent precipitation minus potential evapotranspiration values for the month of September. The P-PE was calculated using long term (1950 - 1980) records.

scale 1:5 000 000

Map 4. Fall moisture balance. (to accompany Land Capability Classification publication)



The contours represent index values taken from a map published by the Alberta Hail and Crop Insurance Corporation (1984).

scale 1:5 000 000

Map 5. Hail index.
(to accompany Land Capability Classification publication)

MAP AREA: ____________ NAME: ____________ Date: ____________

AGROCLIMATE (C)

factor	value	deduction
1. Moisture Component (A)		
P-PE Index	____	____
A = 100	-	____ = ____
2. Energy Component (H)		
E G D D Index	____	____
H = 100	-	____ = ____

factor	value	deduction
3. Modifying factors (% deduction)		
spring moisture	____	____
fall moisture	____	____
local frost	____	____
hail	____	____
		b)____%

Basic Climate rating is lowest of A or H = (a)____

Modification deduction = b% of a=c)____

Final Climate Rating = a - c = ☐

ORGANIC SOILS (O)

factor	value	deduction
1. Surface factors		
energy (EGDD)(Z)		15
decomposition(B)	____	____
wood (I)	____	____
nutrient st.(G)pH=	____	____
salinity (N)	____	____

Basic Organic Rating = 100 - ____ = a)____

factor	value	deduction
2. Subsoil factors (% of deduction)		
depth of deposit(X)	____	
underlying material	____	____
presence of Ah(Y N)	____	____
decomposition (B)	____	____
wood (I)	____	____
acidity (V)	____	____
salinity (N)	____	____

Subsoil deduction = ____% of a)=b)____

Interim soil rating = a - b = c)____

factor	value	deduction
3. Drainage factor (% deduction)		
drainage (W)	____	____

Drainage deduction = ____% of c)=d____

Final Organic Rating (O) = a-(b+d) = ☐

FINAL RATING CALCULATION

	index			factors		%
C =	____	or class	____,	____	____	( )
S =	____	or class	____,	____	____	( )
S =	____	or class	____,	____	____	( )
O =	____	or class	____,	____	____	( )
L =	____	or class	____,	____	____	( )
L =	____	or class	____,	____	____	( )

Index	Class
80 - 100	1
60 - 79	2
45 - 59	3
30 - 44	4
20 - 29	5
10 - 19	6
0 - 9	7

Most limiting component = ____ at an index of ____ or class ____

Other significant components are ____ at an index of ____ or class ____

and ____ at an index of ____ or class ____

Symbol

C S(O) L %

Class ____ ____ ____ ____ ____ ____ ( )

classes factors

Comments

C S(O) L

Class ____ ____ ____ ____ ____ ____ ( )

classes factors

AGRICULTURAL CAPABILITY RATING FORM (1987)

MAP AREA:________________ NAME:____________ Date:____________

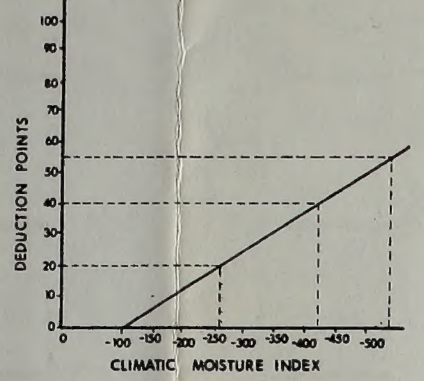
SOILS (S)

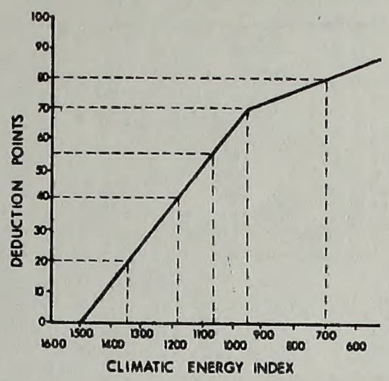
Map Component	1. ________ Name	____ %	2. ________ Name	____ %
factor	value	deduction	value	deduction
1. Surface factors				
texture (M)	________	____	________	____
subsoil adjust.	________	____	________	____
structure (D)	________	____	________	____
org. matter (F)	________	____	________	____
depth (E)	________	____	________	____
acidity (V)	________	____	________	____
salinity (N)	________	____	________	____
sodicity (Y)	________	____	________	____
calcareous (K)	________	____	________	____
organic (O)	________	____	________	____
Basic Soil Rating =	100 -	____ = (a) ____	100 -	____ = a)____
2. Subsoil factors (% deduction)				
structure (D)	________	____	________	____
depth (R,D,M)	________	____	________	____
acidity (V)	________	____	________	____
salinity (N)	________	____	________	____
sodicity (Y)	________	____	________	____
Subsoil deduction =		____% of a=b)____	=	____% of a = b)____
Interim Soil Rating =	a - b =	c)____	a - b =	c)____
3. Drainage factor (% deduction)				
drainage (W)	________	____	________	____
Drainage deduction =		____% of c=d)____		____% of c = d)____
Final Soil Rating(S) =	a - (b + d) =	☐	S = a - (b + d) =	☐

LANDSCAPE (L)

Map Component	1. ________ Name	____ %	2. ________ Name	____ %
factor	value	deduction	value	deduction
1. Slope (T)				
steepness	________%		________%	
length	________m		________m	
LS factor	________		________	
region	________	____	________	____
Basic landscape rating =	100 -	____ = a) ____	100 -	____ = a)____
2. Stoniness (P) (% deduction)				
class	________		________	
average size	________	____	________	____
stoniness deduction =		____% of a)=b)____		____% of a)=b)____
Interim landscape rating =	a - b =	c)____	a - b =	c)____
3. Pattern (J) (% deduction)				
number of obstacles per ¼ section	________	____	________	____
Pattern deduction =		____% of c)=d)____		____% of c)=d)____
Final Landscape Rating(L) =	a - (b + d) =	☐	L = a - (b + d) =	☐

CLIMATE FACTORS





Modifiers

Spring Moisture (P-PE) May	Value(mm)	50	0	+50
	Deduction	0	5	10
Fall Moisture (P-PE) September	Value(mm)	0	50	100
	Deduction	0	5	10
Hail Rate - 1984 (% coverage)	Value	5	10	15
	Deduction	0	5	10
Fall Frost (estimated, days before regional average)	Value(days)	0	15	30
	Deduction	0	5	10

ORGANIC SOIL FACTORS

% fibre	>60	40-60	10-40	<10
von Post	1-2	3-4	5-7	8-10
usual color	lt brown	brown	dk brown	black
Surface deduction	20	15	10	5
Subsurface deduction	10	5	0	10

Wood content % by vol.	Wood content % probes	Surface pt. deduction	Subsurface % deduction
<1	0-10	0	0
2	20	5	0
5	40	10	5
10	80	25	10
25	100	-	25

Nutrient Status

pH \ fibre	>60%	40-60%	10-40%	<10%
>5.5	20	15	10	5
5.0	25	20	15	10
4.5	30	25	20	15
4.0	40	35	30	25
3.5	50	45	40	35

Salinity (dS/m)	Surface point deduction	Subsurface % deduction
2	0	
4	20	0
8	50	10
16	75	20

Compact depth	Underlying material	Percent deduction with ah*	Percent deduction no Ah
40	sandy	10	20
	loamy	0	10
	clayey	10	20
80	sandy	30	35
	loamy	20	25
	clayey	30	35
120	all	50	50

* Dark color humic mineral horizon.

Subsurface acidity	Percent deduction
5 and above	0
4.5	5
4.0	10
3.5	20

Depth to water table(cm)		Percent deduction
Uncontrolled	-at surface	100
	-below surface	70
Controlled	-20 cm	50
	-50 cm	0
	-90 cm	0
	-120 cm	30

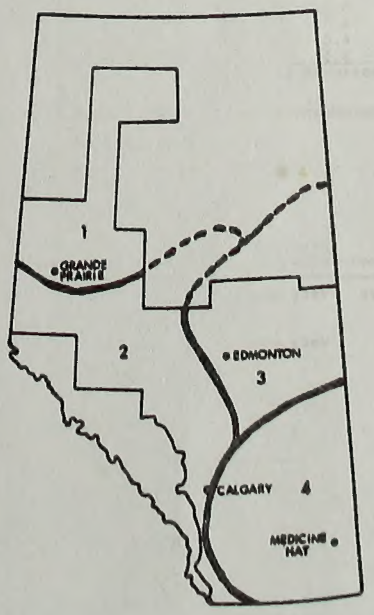
LANDSCAPE FACTORS

LS factor % slope	Slope length(m) 30	50	100	150	200	300
1	0.1	0.1	0.2	0.2	0.2	0.2
2	0.2	0.2	0.3	0.3	0.4	0.4
3	0.3	0.4	0.4	0.5	0.5	0.6
5	0.5	0.7	1.0	1.1	1.3	1.6
7	0.8	1.1	1.5	1.9	2.2	2.7
10	1.4	1.9	2.8	3.5	4.2	4.9
15	2.6	3.7	5.1	6.5	7.8	8.6
20	4.1	5.3	7.4	9.0	11	13

LS (from above)	Point deductions* Region 1&2	Region 3	Region 4
0.1	10	0	0
0.3	20	10	0
0.5	30	20	10
1.0	40	30	20
1.5	40	40	30
2.0	50	50	40
3.0	60	60	50
5.0	70	70	60
10.0	80	80	70
25% slope	85	85	80
30% slope	90	90	85

* Deduct an additional 1 pt. for each 10% exposed or bare soil on steep non-cultivated slopes.

Stoniness class	Comments % Cover	Comments Approx. distance apart (m)	Deduction cobbles	Deduction stones
1	<0.1	20	0	5
2	0.1-3	10	10	30
3	3-15	2	50	70
4	15-50	0.2	70	80
5	over 50	<0.2	90	100



FACTOR EVALUATION SHEET

SURFACE SOIL FACTORS

P-PE	Climate base rating	Surface texture								
		S	LS	SL	L	SIL	CL	SiCL	SiC	C
-100	0	45	25	0	0	0	0	0	0	0
-180	10	55	40	25	10	10	10	10	10	10
-260	20	65	50	35	25	20	20	20	20	20
-340	30	75	60	50	40	30	30	30	30	30
-420	40	85	70	60	50	45	40	40	40	40
-500	50	90	80	70	60	55	50	50	50	50
-540	55	90	80	75	65	60	60	55	55	55

Subsurface Texture Adjustment*

Ave.subsoil texture	Surface texture				
	S	LS	SL	L	SiL-C
S	0	+5	+15	+25	+25
LS	-5	0	+5	+15	+20
SL	-15	-5	0	+5	+10
L	-25	-10	-5	0	+5
SiL-C	-30	-15	-10	-5	0

* This table should not be used if the difference between the surface and subsurface textures is less than 10 points in Table 1.

Structure	Consistence moist; dry	Point deduction
granular, subangular or fine blocky	friable; slightly hard	0
blocky,platy or single grained	firm/loose; hard/loose	5
massive	very firm; very hard	10

% Organic Matter Ah/Ae	Ap	Dry Munsell value	color	Point deduction
>6	>6	2/X	black	0
>6	4-5	3/X	black	0
4-5	3	4/X	dk brown;dk gray	2
3	2	5/X	brown;gray	5
1	1	6/X	gray	10
<1	<1	7/X	light gray	15

Type of subsoil	Depth of topsoil (Ah or Ap) (cm)				
	20	15	10	5	0
Favorable -friable or slightly hard -Bm or Btj horizons	0	0	2	5	10
Unfavorable -very firm, hard, massive or strongly calcareous -Bt,Bnt,Ae or Cca horizons	0	5	10	15	20

Soil pH*	Point deduction
9.0	60
8.5	20
8.0	5
6.5-7.5	0
6.0	2
5.5	5
5.0	15
4.5	30
4.0	55
3.5	80

* If pH measured in 0.01 M CaCl2 add 1/2 unit.

Salinity* (dS/m)	Common features	Point deduction
2	- no apparent signs - affect sensitive crops	0
4	- presence of foxtail - some white specks on surface - some affect on crop growth	20
8	- plants restricted to salt tolerant species (Kochia) - white salt crusts common - crops strongly affected	50
16	- plants restricted to species such as red samphire - salt crust and salts throughout profile - little or no crop growth	90

* Measured in saturation extract.

Sodicity (SAR)	Saturation Percentage (Sat %)	Point Deduction
4	60	0
8	80	10
12	120	30
16	160	50
20	>160	80

%CaCO3(lime)	Reaction to 10% HCl	Point deduction
2	very weak-barely observable	0
5	moderate-bubbles to low foam	5
10	strong-thick foam	10
25	very strong-violent reaction	30

Depth of peat(cm) noncompact	compact	Degree of decomposit	General structure	General consistence	Point deduction
15	15	humic	compact	friable	10
20	15	mesic			15
30	15	fibric	spongy	fibrous	20
30	30	humic	compact	friable	20
40	30	mesic			30
60	30	fibric	spongy	fibrous	40

DRAINAGE

Water table depth (cm) (min.of 1 mo)	Drainage class	Soil/vegetation	Percent deduction
surface for 4 months	very poorly	ponded water	100
surface	very poorly	gleysolic soils/ sedges, slough grass, willows	85
20	poorly	gleysolic soils/ sedges, willows; can hay every year, cultivate occasionally	70
50	imperfectly	gleyed soil (mottling below 50 cm)/ lush growth of poplar, white spruce, willows.	
		can cult 6 yrs out of 10	40
		can cult 9 yrs out of 10	10
100	moderately well	may have some gley features in subsoil/ lusher vegetation growth than surrounding landscape	0

SUBSOIL FACTORS

Structure	Consistence	Common horizons	Percent deduction
prismatic,fine blocky	friable slightly hard	Bm,Btj,Bf Ae,Ck	0
blocky,prismatic	firm hard	Bm(clay,Bt) Btnj	10
blocky,columnar	very firm very hard	Bnt(So,SS)	30
columnar,massive	very dense very compact	Bn,Bnt (ss,Sz)	50

Non conforming layer Kind of layer	Depth to contact (cm)	Percent deduction
lithic: subclass R	100	10
	50	50
	20	90
paralithic: subclass D	100	0
	50	30
	20	50
loam or finer over gravel or gravel and sand: subclass M	100	0
	50	30
	20	50

Subsoil pH*	Percent deduction
6.0	0
5.5	2
5.0	5
4.5	15
4.0	30
3.5	55

*If measured in CaCl2 add 1/2 unit.

EC(dS/m)	Percent deduction
<4	0
4	10
8	20
12	40
16	60

Sodicity (SAR)	Saturation percentage (Sat %)	Percent deduction
4	60	0
8	80	10
12	120	30
16	160	50
20	>160	80

N.L.C. - B.N.C.
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